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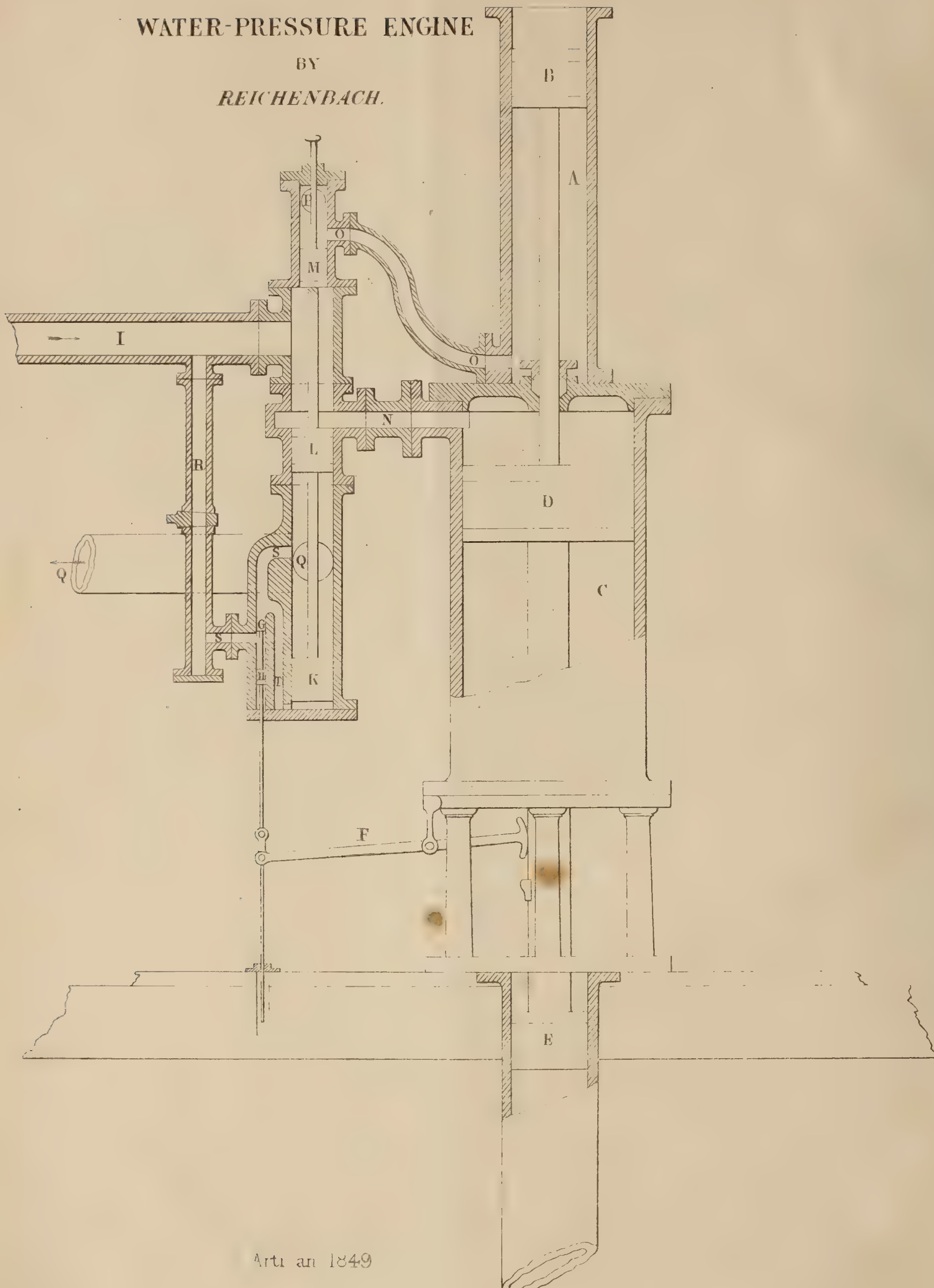
DIRECTIONS TO BINDER.

WATER-PRESSURE ENGINE

BY

REICHENBACH.



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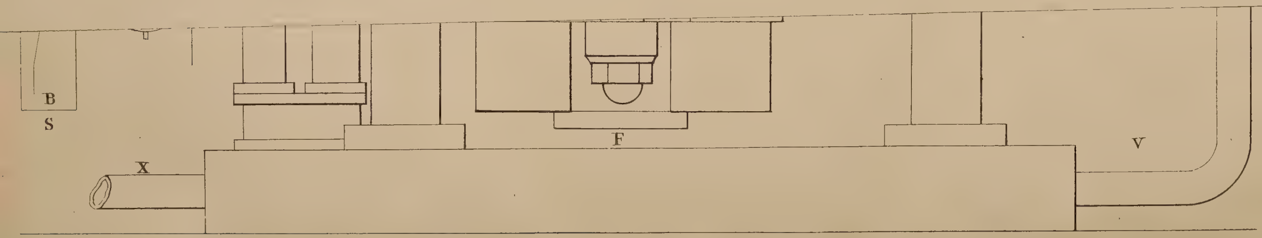

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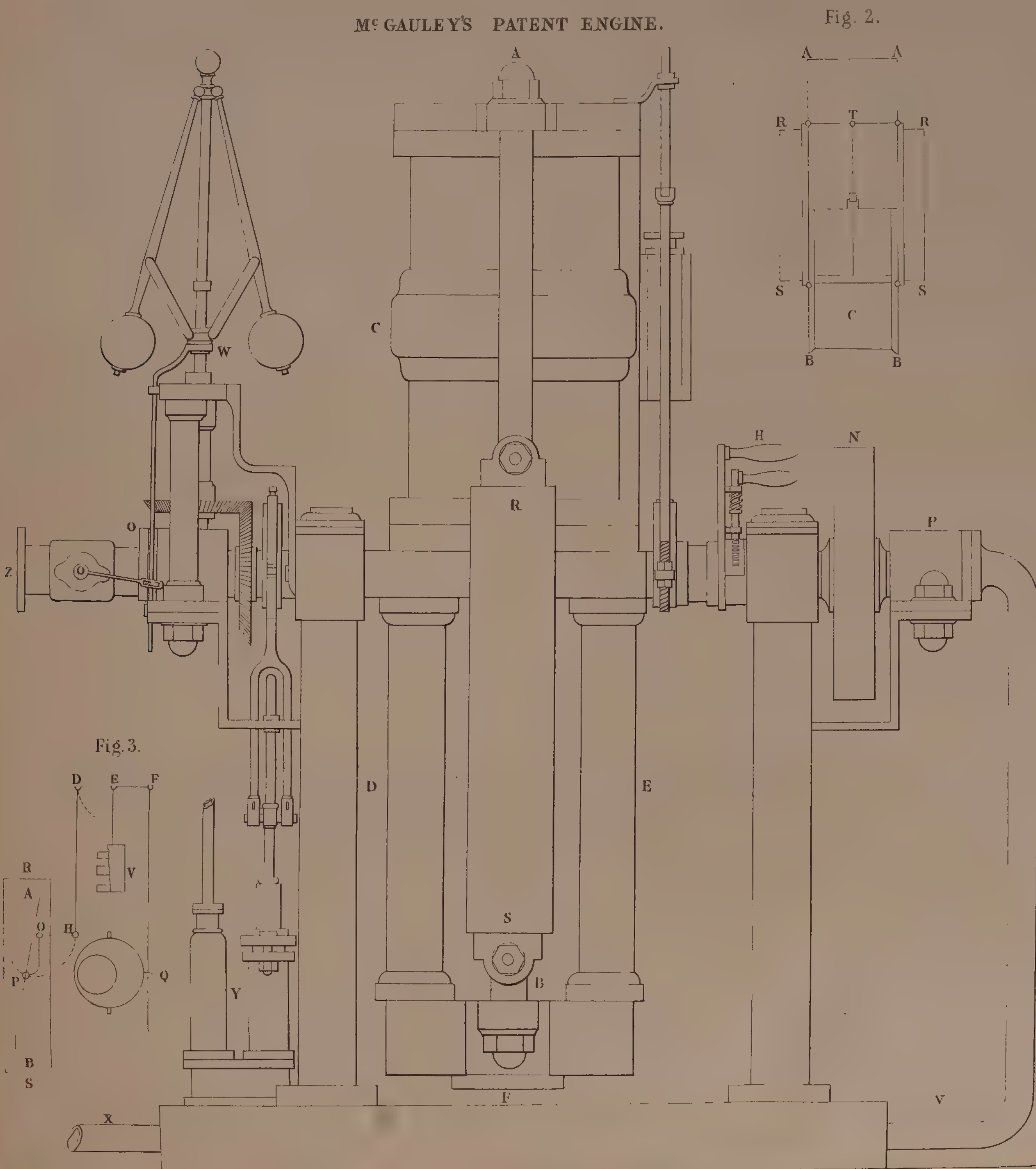
Mc GAULEY'S PATENT ENGINE.



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THE ARTIZAN.

No. I.—Fourth Series.—JANUARY 1st, 1849.

Mechanical Engineering.

Art. I.—ALLINGHAM AND McGAULEY'S ROTARY STEAM-ENGINE.

Since the application of steam to the production of motion, the advantages of what is called a *rotary engine* have been very generally admitted. Indeed, many centuries before the invention of the ordinary steam-engine, a rotary engine was constructed. We need hardly remind the reader, that we allude to the contrivance described by Hero, of Alexandria, 120 years B.C.; and which, although so ancient, has been often claimed in modern times as a new invention.

Attempts to construct a rotary steam-engine have, in many instances, arisen from gross ignorance of the properties of the *crank*, as applied in the ordinary reciprocating engine; some asserting that, of its own nature, the crank destroys power, and others, that no inconvenience whatever arises from its use. Both are equally wrong.

The crank, as can be shewn from the very first principles of mechanics, does not, *of itself*, destroy power. For, the momentum it imparts (friction &c. not being taken into account) is precisely that which it receives from the prime-mover. It undergoes, no doubt, a constant change as to mechanical effect; but it will be found that, as its power diminishes, the motion of the piston in the cylinder, and, in consequence, the steam decreases in exactly the same ratio. Hence no power is destroyed by the crank *directly*.

But, from the mode of its application, power is lost *indirectly*. This is due to what is termed the "obliquity of the connecting-rod." The tangential force required to move the crank round, is in a direction more or less different from that in which the piston travels:—that is, the directions of the force used and the force required are not the same; and this, as the laws of mechanics teach us, must necessarily produce a loss of power. It is, chiefly, to prevent *this* loss that rational attempts to construct a rotary steam-engine are directed.

Rotary engines may conveniently be divided into two classes; those which produce rotary motion *at once* by the acting of the steam—as for instance, when a drum and rotary piston are used; and those which, in some measure like the ordinary steam engine, produce rotary by means of reciprocating motion. As to the drum and rotary piston, however modified, it does not seem probable that they will ever be rendered at the same time, sufficiently simple and permanently steam-tight. On the other hand, an engine which produces rotary from reciprocating motion offers peculiar advantages; since, in using it, we may retain all those details of the ordinary engine, which are really valuable. And some of these are so excellent, that it is likely they will never be surpassed in simplicity and efficiency.

C, fig. 1, is a cylinder of almost the ordinary construction. It is bolted by a square flange, to a corresponding flange carrying the trunnions and the stuffing-box through which the piston-rod works:—these trunnions, flange, and stuffing-box form what we call the *centre piece.* A B represents one of the two guide-bars placed at opposite sides of the cylinder. These bars are strongly bolted, at one end to the cover of the cylinder, and at the other to F, which, along with D and E, forms a counterpoise to the cylinder: these bars are still further strengthened by passing through lugs in the centre piece. A cross head is fixed to the extremity of the piston-rod; and slides, by means of eyes, on the guide-bars. The weights, one of which is represented by R S, are bolted, at one end to the extremities of the cross-head, and at the other to eyes which also connect them to the guide-rods. Fig. 2 represents the mode in which the weights R S, R S, the guide-rods, A B, A B; the cross-head, R T R and the cylinder C are arranged.

W, fig. 1 is the governor moved by bevil wheels: Y, the feed-pump, worked by an excentric; V X is the waste-pipe; the steam-pipe is attached at Z; H is a handle which *fixes* the excentric, belonging to the slide-valve, in any desired position; and thus reverses the engine—which works equally well in either direction; or determines the position at which the weight shall rise, and thus serves as one means of modifying the power of the engine. The slide-valve of this engine is moved not by the revolution of the excentric, but by the revolution of the *ring* in which the excentric is placed. N is a drum, which carries a band for driving machinery. It will not be hard to understand the manner in which this engine produces its effect. When the piston is raised by the steam, it carries up the weights which fall over, and when they come to the proper position are again raised, a continuous rotary-motion being thus produced. This engine has, it is evident, like the ordinary one, its *dead points;* but when these would cause any inconvenience, two cylinders and four weights may easily be used. The engine itself acts a as fly; and the *entire* of it, unless made heavy intentionally, will not weigh so much as the fly-wheel of the ordinary

engine; nor, should economy of space be desired, occupy near as much space. The steam passes into one trunnion from the box O; and from the other trunnions—after having done its work—into the box P, and these boxes are, by means of an extremely simple metallic packing, kept *perfectly* and *permanently* steam-tight, without, almost any friction.

It is evident that, in this engine, as the steam acts *precisely* in the direction in which *it* is intended to produce motion, the loss arising from the obliquity of the connecting-rod is avoided; it will also be seen that it escapes the inconveniences consequent on the various modifications of the oscillating engine.

One of the most serious difficulties we encountered in our experiments, arose from the necessity of bringing the piston and weights *gradually* to rest, and keeping them when raised, in the proper position. None of the methods used for bringing the piston, &c. to rest in the ordinary engine being, as we soon found, at all applicable. If we attempted to stop the piston and weights by a solid body, concussions utterly destructive to the engine would be caused. Springs or buffers, even if admissible on the large scale, would produce a strain and vibration little less injurious than the concussions just mentioned. In our engine the piston and weights are brought to rest without the least strain or vibration. We very commonly work it with trunnions merely *resting* on the brasses, nothing being placed above to confine them; and we can hardly expect it to be believed, without its being seen at work, how uniformly it revolves, and how completely without the least noise or strain. We bring the weights gradually to rest by cutting off the steam at a portion of the stroke and retaining a portion of the waste, which, acting as a soft cushion, destroys whatever little motion may remain in the piston and weights, and brings them fully to a state of rest. The difficulty which we experienced in attaining this, apparently, so simple object, is derived from the necessity of producing *two* motions, each in harmony with the other, and yet perfectly independent:—the revolving motion of the engine must cause the steam to be admitted and the waste to escape; and the upward motion of the weights must be able, at any period of the revolution to cut off the steam, and shut in the required quantity of waste. The mode in which we effect this, is explained in the diagram fig. 3. V is the slide-valve. The valve-rod is attached at E to the small cross-head D F. One extremity of this cross-head is connected by means of a rod, having a joint at F, with the ring moving round the *fixed* excentric. The other end of the cross-head is connected by a rod, having a joint at each end, with the small bell-crank P O H. The extremity P, of this bell-crank carries an eye, through which the bent rod A B traverses, as the weight R S ascends, in consequence of being attached, as already described to the piston-rod. It is evident that from the shape of the rod A B, as the weight R S ascends, the bell-crank is moved round on its centre O, the end D of the cross-head is depressed, and with it the valve V; the steam is first cut off, and, at the proper time, a portion of the waste is shut in; as the engine revolves the excentric ring again opens the ports. Each extremity of the cross-head acts as a fulcrum to the other extremity; and neither motion can possibly interfere with the other.

Centrifugal force does not cause a loss of power in this engine; for it gives back, during one half of the stroke as much as it absorbed during the other.

Although one part of the weights may be said to neutralize *some* of the effect of the other, no force is wasted, since just as much steam is used as will raise the common centre of gravity of the weight through a certain distance; and as much force is given back as will arise from this centre of gravity falling through the *same* distance.

The trunnions are not more strained than those of the oscillating engine; for it is immaterial whether the force of the engine is exerted against the trunnions directly, or indirectly through the medium of gravitation.

The weights required are not inconveniently ponderous; on the contrary, they are, comparatively, insignificant in size, as will be evident, on making the necessary calculations.

ALLINGTON & M'GAULEY,
DUBLIN.

ART. II.—WATER-PRESSURE ENGINE BY REICHENBACH.

In another part of our Journal will be found a report of Mr. Glynn's paper, read before the Society of Arts, on Water-pressure Engines. During the discussion which followed, Mr. Brunel, the Chairman, observed (in reference to a suggestion as to using water-power on the small scale for general purposes,) that in a case with which he was connected, a town was to be supplied with water by a gravitation water-works, at a pressure, and at a price, which would render its use not inconsistent with economy. Amongst our Patent Specifications will also be found a description of Mr. Armstrong's engine, to be worked by water pressure. One of similar construction, described p. 131 of our last volume, has been working at Newcastle with considerable success, though we apprehend some difficulty would be found in changing the reciprocating motion into rotatory, more particularly in a large engine, unless a low velocity were used. One of Whitelaw & Stirratt's Wheels would be more economical in first cost, and also in repairs, and its direct rotary motion more useful in the majority of cases. The engines to which Mr. Glynn chiefly adverted were those which had been erected in this country, and on the Continent for the purpose of draining mines, and we have given this month an engraving of one of the most celebrated, erected at Illsang, in Bavaria, for the purpose of pumping up salt water to supply the salt works in that district.

The working of the engine will be easily understood from the drawing, to the details of which the following letters refer.

A the upper cylinder.
B the piston of the upper cylinder.
C the lower cylinder.
D the piston of do. on the same rod at the piston B.
E the pump plunger, on the same rod as the pistons B and D, the rod passing through a stuffing-box in the top of cylinder C.
F a lever worked by tappets, to work the piston slide-valve G, which is on the same rod as the piston H, the latter acting as a stuffing-box.
I the induction pipe, supplying the head of water.
K L M three piston-valves, on the same rod, and moving together; K and L being of the same diameter, and M smaller than K and L.
N the port or passage of the lower cylinder C, and closed by the piston L.
O O passage of the upper cylinder A, closed by the piston-valve M.
P the eduction pipe from the upper cylinder A.
Q the eduction pipe from the lower cylinder C.
R a pipe leading from the main supply pipe I, to the piston-valves K and L, through the passages S S, and S T. There is a cock on this pipe, by shutting which the motion of the engine may be arrested.

The engine is represented at the the top of its stroke, the water being raised by the descent of the pump plunger E as in ordinary pumping engines. The valves being in the position shown, the pressure of the water entering into the cylinder C and pressing upon the piston D, will force down the piston and pump plunger, and raise the water load. The downward stroke being terminated, the weight of the pistons, rods, plungers, &c. has to be raised, which is effected by causing the pressure of the water to act upon the under side of the upper piston B. This is effected in the following manner: The piston valve G being raised by the lever F, opens the passage into T, and allows the water to pass along R, S, T, and press on the under side of the piston K; but at the same time, the water is pressing on the top of the piston L, and these two pistons being of the same diameter are in equilibrium, and would remain stationary, were it not for the small piston M on the same rod, which being also acted upon by the pressure of the water, raises the three pistons at once,—thus a passage is opened along O O for the water to enter on the underside of the piston B, and the water which had filled the cylinder C is allowed to escape through N, out of the eduction pipe Q.

Upon the valves being again changed by the tappets, the water which had filled the cylinder A, escapes along the passages O O, and out of the pipe P, and the water which had raised the piston valve K, passes to the upper side of the piston valve, and escapes through the pipe Q; and in this manner the action of the engine is maintained.

We shall be happy to receive any information which our readers can give us on this interesting subject, particularly as regards the amount of concussion observed consequent on the incompressibility of the water, and the speed in feet per minute at which such an engine can be worked.

Art. III.—RULES FOR CALCULATING THE RESISTANCE IN MACHINES, CAUSED BY THE STIFFNESS OR RIGIDITY OF CORDS IN PASSING OVER PULLIES AND OTHER CYLINDRICAL BODIES, DEDUCED FROM THE EXPERIMENTS OF M. AMONTONS.

Since pulleys and cords are of very extensive use in mechanical combinations, it is of the greatest importance to know the amount of resistance caused by the rigidity of the cords, according to the weight to be raised, the diameter of the cords and the diameter of the pulleys. It does not appear that this subject is particularly attended to in mechanical operations; but we shall show by and bye, that the neglect of it is of greater consequence than is generally imagined, and that it is not a matter of indifference whether large or small pullies be employed for any specified purpose.

We have heard it maintained by practical mechanics and engineers of very high standing, that since the power applied, and the weight to be raised, are each supposed to act in directions perpendicular to the horizon, it can make no difference in the result, whether the pulleys on which the cords act be large or small; this, however, is an error in judgment, and one of greater magnitude than those who maintain this doctrine will be willing to admit. The principles upon which our calculations are founded are strictly of an empirical nature, but when we consider the cautious accuracy of the experimentalist who supplied them, and the very rigorous agreement of the results with others that have been obtained from actual trials, there can be no doubt that the deductions are just, as far as accuracy can be elicited from experiment alone.

The following are the experiments from which the rules of calculation are deduced, and if they have been accurately recorded, it will at once be admitted that the rules which they supply may be implicitly relied on within the limits of practice.

In the first place, then, it was found that 2.8125 pounds overcame the resistance of two cords, each of three lines* in diameter, the cord being loaded with a weight of 20 pounds, and the diameter of the pulley or cylinder one inch and a half.

When the cord was loaded with a weight of 40 pounds, the resistance was overcome by 5.625 pounds, and when loaded with 60 pounds, it was overcome by 8.4375 pounds; from which it will be seen, that under the same circumstances, equal increments of weight produced equal increments of resistance. From which we deduce the following general law:—

That the resistance caused by the stiffness of cords, about the same or equal pulleys, varies directly as the suspended weight.

Again, by continuing the experiment, it was found that with the same pulley or cylinder, 1.875 pounds surmounted the resistance of two cords, each of 2 lines in diameter, and loaded with a weight of 20 pounds; and 0.9375 pounds overcame the resistance of two cords, each of 1 line in diameter, loaded in like manner with a weight of 20 pounds. From which we deduce the following general law:—

That the resistance caused by the stiffness of cords, increases not only in the direct proportion of the suspended weights, but also in the direct proportion of the diameter of the cords.

Consequently, by combining these two proportions, the ultimate general law for the estimation of the resistance, may be enunciated as follows:—

That the resistance to motion on the same or equal pulleys, caused by the stiffness of cords, is in the direct compound proportion of the suspended weight and the diameter of the cords.

We are not to suppose that the increased resistance caused by the increased diameter of the cords is owing to the greater quantity of matter they contain; for if this were the case, the increased resistance would be according to the squares of the diameters, and not as the diameters simply. The true reason of the increased resistance is to be sought for in the removing of the point at which the suspended weight acts, to a greater distance from the point of support.

And on the other hand, a diminution of resistance in consequence of the decrement of the diameter of the cord, proceeds from the removing of the point at which the weight is suspended, to a less distance from the point of support.

Continuing the experiment, it was further found, that with a pulley or cylinder of one inch and a half in diameter, a weight of 5.625 pounds surmounted the resistance of two cords of three lines diameter, and loaded with a weight of 60 pounds; and 7.125 pounds overcame the resistance of the same two cords, on a pulley or cylinder of one inch in diameter; while it required a weight of 8.4375 pounds to overcome the resistance on a pulley or cylinder of half an inch in diameter.

By examining these results, it will be seen, that as the diameter of the pulley increases, the resistance decreases, and on the contrary, as the diameter decreases, the resistance increases—but the variation of the resistance, either increasing or decreasing, is not in the exact inverse proportion of the variation in the diameter of the pulleys or cylinders on which the experiments were made; for if that were the case, the resistance would be 5.625, 11.25, and 16.875 pounds; the diameters being as 1, 2, and 3.

There were two other sets of experiments performed with pulleys and cords of different diameters, all of which gave results differing in very nearly the same proportion, and upon the whole, the law of resistance, as deduced from a combination of all these experiments, is as follows, viz.—

The resistance caused by the stiffness of cords passing over a pulley or other cylindrical body, is in the direct compound ratio of the weight suspended in pounds, and the diameter of the cord in lines, and in the inverse ratio of the diameter of the pulley in inches.

This law is sufficiently simple for practical application to mechanical enquiries, and ought to be employed in every case where ropes and pulleys form a part of the arrangement. It may be expressed analytically, as follows:—

Put w=the weight to be estimated in pounds;

d=the diameter of the rope or cord expressed in lines;

D=the diameter of the pulley or cylinder in inches;

r=the resistance in pounds, caused by the stiffness of the cords,

and c=a constant quantity deduced from experiment=0.03125.

Then we have $r=\frac{0.03125dw}{D}$; of which fraction the values of the numerator for all diameters of cord, from 1 line to 36 lines or 3 inches, are exhibited in the following.

In calculating the resistance arising from the stiffness of cords, it must be borne in mind, that there is more than one resistance to account for; because whatever resistance is due to the suspended weight, when added to the motive power, in order to produce motion, cause an additional resistance which must also be counterbalanced before motion can take place; and this additional resistance being added to the motive power, does again augment the former resistance, and must therefore also be taken into the account, and so on, till the resistances are totally annihilated; and when that takes place a little additional power will produce motion in the machine. To facilitate the calculation of the resistances, caused by the stiffness or rigidity of cords in machines, we have computed the following table, for cords of all diameters, from 1 line to 36 lines, and for suspended weights from 1 pound to 10 pounds, which also serves for all other weights by a simple multiplication only. The tabulated numbers are represented by the numerator of the fraction in a foregoing formula; but the resistance requires the division of the tabulated numbers by the diameter of the pulley in inches.

* The diameters of the cords are always estimated in lines or twelfths of an inch, while the diameters of the pulleys are estimated in inches.

PRINCIPAL ARGUMENT—WEIGHT TO BE RAISED, POUNDS AVOIRDUPOISE.

Dia. of cord in lines.	1-lb.	2-lbs.	3-lbs.	4-lbs.	5-lbs.	6-lbs.	7-lbs.	8-lbs.	9-lbs.	10-lbs.
1	0.0313	0.0625	0.0938	0.125	0.1563	0.1875	0.2188	0.25	0.2813	0.3125
2	0.0625	0.1250	0.1875	0.250	0.3125	0.3750	0.4375	0.50	0.5625	0.6250
3	0.0938	0.1875	0.2813	0.375	0.4688	0.5625	0.6563	0.75	0.8438	0.9375
4	0.1250	0.2500	0.3750	0.500	0.6250	0.7500	0.8750	1.00	1.1250	1.2500
5	0.1563	0.3125	0.4688	0.625	0.7813	0.9375	1.0938	1.25	1.4063	1.5625
6	0.1875	0.3750	0.5625	0.750	0.9375	1.1250	1.3125	1.50	1.6875	1.8750
7	0.2188	0.4375	0.6563	0.875	1.0938	1.3125	1.5313	1.75	1.9688	2.1875
8	0.2500	0.5000	0.7500	1.000	1.2500	1.5000	1.7500	2.00	2.2500	2.5000
9	0.2813	0.5625	0.8438	1.125	1.4063	1.6875	1.9688	2.25	2.5313	2.8125
10	0.3125	0.6250	0.9375	1.250	1.5625	1.8750	2.1875	2.50	2.8125	3.1250
11	0.3438	0.6875	1.0313	1.375	1.7188	2.0625	2.4063	2.75	3.0938	3.4375
12	0.3750	0.7500	1.1250	1.500	1.8750	2.2500	2.6250	3.00	3.3750	3.7500
13	0.4063	0.8125	1.2188	1.625	2.0313	2.4375	2.8438	3.25	3.6563	4.0625
14	0.4375	0.8750	1.3125	1 750	2.1875	2.6250	3.0625	3.50	3.9375	4.3750
15	0.4688	0.9375	1.4063	1.875	2.3438	2.8125	3.2813	3.75	4.2188	4.6875
16	9.5000	1.0000	1.5000	2.000	2.5000	3.0000	3.5000	4.00	4.5000	5.0000
17	0.5313	1.0625	1.5938	2.125	2.6563	3.1875	3.7188	4.25	4.7813	5.3125
18	0.5625	1.1250	1.6875	2.250	2.8123	3.3750	3.9375	4.50	5.0625	5.6250
19	0.5938	1.1875	1.7813	2.375	2.9688	3.5625	4.1563	4.75	5.3438	5.9375
20	0.6250	1.2500	1.8750	2.500	3.1250	3.7500	4.3750	5.00	5.6250	6.2500
21	0.6563	1.3125	1.9688	2.625	3.2813	3.9375	4.5938	5.25	5.9063	6.5625
22	0.6875	1.3750	2.0625	2.750	3.4375	4.1250	4.8125	5.50	6.1875	6.8750
23	0.7188	1.4375	2.1563	2.875	3.5938	4.3125	5.0313	5.75	6.4688	7.1875
24	0.7500	1.5000	2.2500	3.000	3.7500	4.5000	5.2500	6.00	6.7500	7.5000
25	0.7813	1.5625	2.3438	3.125	3.9063	4.6875	5.4688	6.25	7.0313	7.8125
26	0.8125	1.6250	2.4375	3.250	4.0625	4.8750	5.6875	6.50	7.3125	8.1250
27	0.8438	1.6875	2.5313	3.375	4.2188	5.0625	5.9063	6.75	7.5938	8.4375
28	0.8750	1.7500	2.6250	3.500	4.3750	5.2500	6.1250	7.00	7.8750	8.7500
29	0.9063	1.8125	2.7188	3.625	4.5313	5.4375	6.3438	7.25	8.1563	9.0625
30	0.9375	1.8750	2.8125	3.750	4.6875	5.6250	6.5625	7.50	8.4375	9.3750
31	0.9688	1.9375	2.9063	3.875	4.8438	5.8125	6.7813	7.75	8.7188	9.6875
32	1.0000	2.0000	3.0000	4.000	5.0000	6.0000	7.0000	8.00	9.0000	10.0000
33	1.0313	2.0625	3.0938	4.125	5.1563	6.1875	7.2188	8.25	9.2813	10.3125
34	1.0625	2.1250	3.1975	4.250	5.3125	6.3750	7.4375	8.50	9.5625	10.6250
35	1.0938	2.1875	3.2813	4.375	5.4688	6.5625	7.6563	8.75	9.8438	10.9375
36	1.1250	2.2250	3.3750	4.500	5.6250	6.7500	7.8750	9.00	10.1250	11.2500

USE OF THE TABLE.—Look in the marginal columns for the diameter of the cord expressed in lines or twelfths of an inch, and at top, find the integer which corresponds to the first figure in the number expressing the suspended weight; then opposite the one and under the other, take out the corresponding number from the body of the table. If the weight be upwards of a thousand pouuds, and below ten thousand, multiply the tabular number by 1000 and reserve the product.

Again, find the diameter as before in the marginal column, and the second figure of the weight at the top, and multiply the tabular number corresponding by 100, and reserve the product also; multiply the next by 10, and to the sum of these products add the tabular number corresponding to the figure in the unit's place; and the sum of them all divided by the diameter of the pulley in inches, will give the resistance arising from stiffness of the cord caused by the original suspended weight. The following example will render the subject perfectly clear.

Example.—What will be the resistance occasioned by the stiffness of a cord of 18 lines in diameter, passing over a pulley of 2 inches diameter, the suspended weight being 2393 pounds?

Opposite 18 lines, and under 2 pounds, we get 1.1250, which multiplied by 1000 gives . . . . . 1125.

Opposite 18 lines, and under 3 pounds, we get 1.6875, which multiplied by 100, gives 168.75

Opposite 18 lines, and under 9 pounds, we get 5.0625, which multiplied by 10, gives 50.625

Opposite 18 lines, and under 3 pounds, we get . . 1.6875

Then by adding all the products together the sum=1346.0625

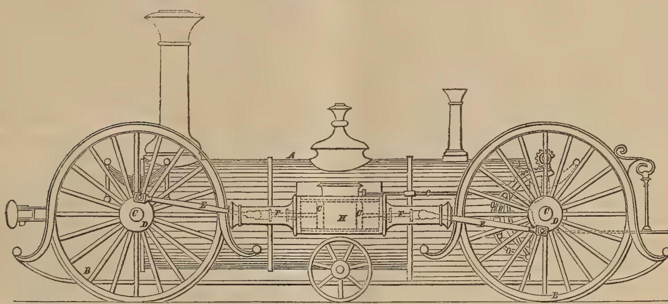
Therefore, if this sum be divided by 2 inches the diameter of the pulley, we get 1346÷2=678 lbs, for the resistance of the rope.

But this 678 pounds will cause another resistance, which must be estimated in the same way; thus we have, in the table.

Opposite 18 lines, and under 6 pounds. 3.3750, which × 100 gives	337.50
Opposite 18 lines, and under 7 pounds, we get 8.9375, which × 10 gives	39.375
Opposite 18 lines, and under 8 pounds, we get 4 . .	4.5
Adding these together, we get	381.375

And dividing by 2, the resistance is 196 pounds; which again gives a resistance of 55 pounds; this a resistance of 15 pounds, and this again a resistance of 4, which finally gives a resistance of 1 pound: consequently, the accumulated resistances, are 678+196+55+15+4+1=949 pounds; so that the motive power must not be less than 2393 + 949=3342 pounds, and if the pulley were only of one inch diameter, would require to be 2393 +1898 42 91 pounds.

Art. IV.—RITCHIE'S IMPROVEMENTS IN LOCOMOTIVE ENGINES.



This patent includes several important points in the construction of locomotives, the most prominent of which are shown in the accompanying sketch. This arrangement consists in having a separate piston and connecting-rod, to each of the four driving-wheels, two pistons working in one cylinder, on each side of the engine. By this means the momentum of the moving parts will be neutralised, and consequently, the oscillation of the engine, in a great measure, obviated; the two pistons GG working in opposite directions in the cylinder H, and the power being communicated in the ordinary manner, through the connecting-rods EE, to the driving-wheels BB.

Another improvement consists in a method of reversing the action of the slide valve, with one fixed eccentric, which is effected in the following manner:—the eccentric ring has two rods attached to it, the ends of which are connected together with a curved slotted link marked OO. These rods work respectively in the pins at the ends of a double lever P, the centre of which is carried by a pin off the boiler, and represents the ordinary weigh-shaft. Thus, when the link is down, as in the drawing, the upper eccentric-rod works the slide valve directly off the upper end of the lever; but when the link is raised, by means of the toothed segment and pinion shown, the lower eccentric-rod is thrown into gear with the lower end of the lever, and works the valve to drive the engine in the opposite direction; the levers are arranged so as to give the proper lead to the valve in either direction. By having a slot in the upper end of the lever P, the stroke of the valve may be diminished, and the steam worked expansively, as in the ordinary slot link motion.

Mr. Ritchie also shows an improved arrangement of safety-valves, in order to obviate the increased power of the helical spring when compressed. This is effected by having, what he terms, a compensation flange, let into the seat of the ordinary valve, and which presents an increased surface for the steam to act upon, when the valve rises.

Another valve which is called an indicator safety-valve, is shown, consisting of a piston, which is fitted into a tube, having a spring attached to it—lateral openings being made in the tube, to allow the steam to escape when the piston becomes raised above such openings, and by making the said tube moveable within another one, the "blowing off" point may be varied at pleasure. An index, like that of a barometer, may then be attached to the piston-rod, and will indicate very slight variations of pressure. A regulating valve is attached, the construction and arrangement of which is as follows:—There is a short socket-pipe, having two conical valve seats formed therein, into which the valves fit—such valves being connected together, or formed upon one stem, into which one end of a rod is screwed, or otherwise made fast, and the opposite end of the said rod attached to a spindle, working through a stuffing-box, to which a hand lever is fixed.

The steam acting equally on the two valves neutralizes the pressure, and allows the valve to be easily worked.

There is also an arrangement to diminish priming consisting of a system of perforated plates.

A self-acting feeding apparatus is described, consisting of a small steam cylinder, the piston-rod of which is connected to the pump-plunger, the slide-valve being worked by tappets, and supplied with steam from the boiler of the locomotive.

The splashers are proposed to be made so as to act as a break upon the driving wheels, in the event of an axle breaking, the parts being made of sufficient strength to serve this purpose.

In order to ensure a sufficient depth of water over the the fire-box, Mr. Ritchie proposes to carry up the tube-plate with a partition across the end of the fire-box. The water then being pumped into the fire-box water spaces, will first fill them and then overflow into the tube spaces.

The claims are substantially as here described.

Boiler Explosions.—It gives us great pleasure to notice the praiseworthy exertions now being made by the ironmasters in South Staffordshire to prevent accidents by steam boilers, which unhappily of late years have been of so frequent and disastrous occurrence in the neighbourhood both to life and property. We learn, that in addition to the many precautions already adopted, the ironmasters are entering into a union generally to employ an inspecting engineer, to examine and report monthly to them upon the working condition of all their boilers and engines. This plan is carried out to great extent, and with perfect success, we believe, in Cornwall, and although the low price of coals may be considered a reason, in a pecuniary point of view at least, why it need not be followed out to the same extent in this district, we are sure that great improvements may be made, and that in a commercial point of view it would be found of much value. It must also prove very satisfactory to the foreman and engineers employed in the different establishments, since, by the adoption of the proposed plan, much responsiblity will be taken from them in cases of accident, and the rumoured interference on the part of the Legislature would also be rendered unnecessary.—*Birmingham Journal.*

Royal Steam Navy.

ART. V.—PROMOTIONS AND APPOINTMENTS.

Second Class Chief Engineer.—JOHN TURNER, to the *Fearless.*

Assistant Engineers.—GEORGE FISH, to the *Fisgard.* THOMAS RIDING, and SAMUEL GRIFFITHS, to the *Rosamond.* EDWARD O. CRICHTON, JOHN P. ALLEN, and GEORGE COOK, to the *Blenheim.* EDWARD CRUMP, WILLIAM M'DOWALL, and HENRY J. WILKES, to the *Plumper.*

TRIALS OF STEAMERS.

DOCK-YARD INTELLIGENCE.

Ajax, 26, screw guard-ship, proceeded on the 12th inst. to make another trial of her engines, under the command of Commander Stevens, of the *Blenheim,* with a crew from that ship. She went out of Portsmouth harbour at half-past ten, a.m., having on board Rear-Admiral Superintendent Prescott, C.B.; Captain Chads, C.B.; a number of naval officers and scientific gentlemen, including Messrs. Maudslay and Field. The *Ajax* made good way against a strong flood tide, using steam at a light pressure; but after rounding the Spit buoy, she put on more steam, and ran down to Stokes' Bay at a good pace. When in Stokes' Bay, she was unexpectedly honoured by a visit from his Royal Highness Prince Albert.

The Prince, attended by Major General Wemyss, being on board the *Fairy* yacht in the waters of the Solent, having expressed a wish to see the *Ajax,* Captain Crispin conveyed his Royal Highness on board. His Royal Highness was conducted round the ship, and remained on board about an hour, during which time the *Ajax* was running the measured mile; he visited the engine-room, and made inquiries into the minutiæ of the machinery, and went round the decks and inquired into the nature of her intended armament. On the Prince quitting the ship, he was heartily cheered by the crew. The *Fairy* then returned to Osborne.

At about three p.m., the *Ajax* set a temporary fore-staysail, and returned into harbour against the full force of a strong ebb tide. When at the narrows, between Blockhouse Point and the Custom-house watch-house, she remained stationary for some time, the stokers having let the fires get low, but she at length got through, and proceeded to her moorings.

As at her last trial, the *Ajax* had only her bare lowermasts and bowsprit, but she had 560 tons of ballast to bring her down to her proper line, when fully equipped.

The results of her trial were altogether most satisfactory. The engines, with the exception of a slight tendency to hot bearings, working admirably. The ship steered as easily, and there was but little ebullition of water abaft, neither did the water rise much in the well of the screw.

	Ft.	In.
Draft of water, aft	22	3
Ditto, forward	20	$4\frac{1}{2}$

about nine inches less than the *Blenheim.*

Strokes per minute.	Mile.	Time per mile.		Speed.		Mean.
$42\frac{1}{2}$	1st	8	25	7.128	6.376	6.405
$42\frac{1}{2}$	2nd	10	40	5.625		
$41\frac{1}{2}$	3rd	12	30	4.800	6.485	
$40\frac{1}{2}$	4th	7	26	8.017	6.481	6.458
$41\frac{1}{2}$	5th	12	16	4.891		
		Total mean of 5 runs				6.431

Barometer ... ... 26 deg. 30m.
Pressure ... ... 5lbs. 8oz.

The average speed of the *Blenheim* is 6.5

Fairy, screw steam-tender to the Royal Yacht, Master Commander Welch, is ordered to have a new entablature from Penn and Co.

Encounter, screw-ship, went out of harbour on Friday, the 25th ult., to try her speed, under command of Commander Stevens, of the *Blenheim.* She had all her guns, shot, and stores on board, and drew about 12 feet 1 inch aft, and 11 feet 4 forward. It is considered that her crew and other weight to be put on board, when fitted for service, would be from 60 to 70 tons more, which would probably bring her four or five inches deeper in the water. A number of officers and gentlemen went out in her, and Rear-Admiral Superintendent Prescott, C.B., followed her out, and went on board her in Stokes' Bay. Her engines worked admirably. She made 74 to 75 revolutions; the last time she was tried, when light, she made, we believe, 78. Her mean speed was 9 knots 3-10ths, on five trials, along the measured mile. She returned into harbour at three o'clock.

Rifleman, Lieut. Com. Crofton, and *Sharpshooter,* Lieut. Com. Bailey, returned to Spithead on Saturday morning from their experimental cruise in the channel, under the superintendence of Capt. H. T. Austin, C.B., of the *Blenheim.*

The following are the reports of their performances during their cruise.

In smooth water to determine the relative consumption of fuel, the *Sharpshooter* (202 horse-power) kept pace with the *Rifleman,* working at a very reduced speed.

Against a closereefed-topsail breeze, and a corresponding sea, the *Rifleman* (100 horse-power) had the advantage of nearly three miles an hour.

Under steam and sail, the speed of the two vessels may be considered nearly equal.

Under sail alone, the *Rifleman* appeared to have a slight advantage. The want of time is alleged as preventing the relative capabilities of the two vessels on this point being satisfactorily determined.

On Tuesday the 21st ult., the *Sharpshooter* and *Rifleman* left Yarmouth Roads in order to encounter a gale of wind, to try the superiority of the *Sharpshooter* steaming against a head sea. After being at sea four days, the result of the trials was, that the *Rifleman* proved her superiority in all points of sailing. On a wind, the *Rifleman* beat the *Sharpshooter* upwards of three knots in the trial, which was the only one wherein both ships were esteemed on a perfect equality. On Saturday both vessels tried sailing with the wind on the quarter, studding-sails set, when the *Rifleman* was fast overhauling the *Sharpshooter,* but signal was made, "Try steaming and sailing," and although *Sharpshooter* is 102 horse-power more than *Rifleman,* she only gained on her a quarter of a mile in two hours.

On Monday morning the *Rifleman* and *Sharpshooter* proceeded to Stokes' Bay to try speed along the measured mile. The *Rifleman,* three trials up and down at full speed, averaged 8.5 knots, and working at the lowest expansion 7.827 knots per hour, thereby showing that by using her lowest step of expansion-gear, her speed is the same within half a knot as though she was working full speed, with a saving of one-third of the quantity of coals. Revolutions at full speed, 43; at the 3rd step of expansion, 37.

Revolutions made each mile by the engines:—

First mile	311
Second mile	336
Third mile	320
Fourth mile	481
Fifth mile	346
Sixth mile	300
Seventh mile (expansion gear, 3rd grade) ...	355

Revolutions of the screw:—

First mile	777
Second mile	840
Third mile	800
Fourth mile	702
Fifth mile	865
Sixth mile	750
Seventh mile	887

The *Rifleman* came into harbour on Monday afternoon to be docked, in order to discover the leak in the stern frame, which appeared while in the gale of Tuesday the 21st, in which from her rolling motion the *Sharpshooter* carried away and lost her port quarter boat. The conclusion which may be drawn from the trial is, that the *Rifleman,* notwithstanding the superiority of wood over iron, has shown herself to be superior in every point of sailing, and as to steaming, comparatively speaking, more efficient than the *Sharpshooter,* inasmuch as the *Rifleman* can steam 23 miles with one ton of coals, and 31 expansively at the lowest step, and the difference of speed between her and the *Sharpshooter* is not more than one knot, although the engines of the latter are 102 horse-power more than the former.

Archer, screw gun-vessel, building at Deptford, is to be launched as soon as possible, to have the engines (by Miller and Ravenhill) of 202 horse-power, taken out of the *Rifleman*, fitted to her.

The *Sanspareil*, 84.—We learn that the report of cutting down this noble ship, designed from the lines of that magnificent trophy bearing the same name acquired in the glorious victory of 1st June, 1794, is unfounded; we are now told that the Admiralty have decided on converting her into a screw-ship, and have directed one of the pairs of screw-engines of 350 horse-power, ordered for the frigate steam guard-ships, to be appropriated to her.

Admiralty Railways.—It has been determined on by the Admiralty to introduce a system of railways or tramways in the different dockyards of the kingdom, for the transmission of timber and stores to the water's edge, and to one part or other of the neighbourhood. The suggestion is understood to emanate from Mr. Ward, M.P., the Secretary to the Admiralty. By the adoption of this plan it is expected that a considerable saving will be effected in the item of "teams." For this purpose an outlay of £6,661 will be made during the present year at Deptford, Woolwich, Chatham, Sheerness, Plymouth, Portsmouth, and Pembroke.

Early Study of Steam.—The Admiralty have determined that in future an acquaintance with the principle and application of the steam-engine shall be deemed a necessary qualification for all midshipmen before they can be allowed to pass for the rank of lieutenant.

The Board of Admiralty, in prosecuting the task of revision, have directed that in future when any vessels are ordered to be repaired an estimate shall be furnished of the probable expense; and should the amount estimated prove insufficient, a supplementary estimate is to be submitted for their approval. Their Lordships have further directed returns to be transmitted showing in detail the expense of manufacturing a ton of cake copper into 28-ounce sheets, also in rolling the same quantity into bolts or bars; with the expense in manufacturing a ton of iron into sheets, and the same quantity into bars, adding a separate statement of the expense of coal, labour, &c. They have also commanded a report to be prepared and transmitted to them showing the expense per ton of manufacturing blooms and blanks with Nasmyth's hammer, stating in detail the cost of fuel, labour, repair of hammer, and other incidental expenses, together with the cost of hammer &c. They have also directed a return to be prepared of all the yard steam-engines and machinery, whether in use, appropriated, unapropriated, or obsolete, stating the horse power, diameter of cylinder, pressure at which the engine can be worked, name of maker, when ordered, and when received, the first cost and present value, and the state of repair of both the engines and machinery of every description, and if out of repair the nature of defects and the estimated cost of repair, together with any remarks the engineer officers may have to offer. This will convey an idea of the measures in progress.

Grant's Cooking Galley.—The distilling and cooking galley, invented by Mr. Grant, F.R.S., Storekeeper, Clarence Victualling-yard, such as the apparatus fitted on board the Reynard, is made of stout copper, well tinned, and stands where the old galley did, occupying but two-thirds of the space; a tin case in which the steam is generated surrounds the coppers, so that the operation of cooking is performed by steam. This steam passes off into the condenser (a square copper box, strapped up to the beams under the galley), and by means of a worm of numerous coils, is retained long enough to allow of its condensation by a jet of cold water admitted through a sea-cock, about four feet below the water line, abreast of the condenser. The quantity of water admitted for this purpose can, of course, be regulated at pleasure, and when it has done its duty, it is conducted by a pipe into the bilge in the engine-room, to be pumped out by the bilge pumps, or by a pump to force it on deck. The distilled water runs out of the worm, and is conducted by a hose into the tanks in the fore-hold. The quantity yielded when everything is in proper order is expected to reach ten gallons per hour; and as the apparatus will be in operation 12 hours, 120 gallons, or more than enough for every purpose for the ship's company, will be distilled daily. The arrangemets for cooking are very complete; besides the coppers for the ship's company, circular pots, like deep stewpans, are provided for cooking the officer's meals in, together with a large kettle on either side for steaming or boiling fish, &c. There is one oven, and the range is large enough to admit of a large joint being roasted. No cooking utensils being required besides those actually forming part of the apparatus, a considerable item in the outfit of a mess will be saved the officers.

A new method of testing the soundness of the manufacture of the anchors intended for the use of Her Majesty's ships and vessels has recently been established at Portsmouth, at the suggestion and under the direction of Mr. Owen, foreman of shipwrights, and metal master to the Board of Admiralty. In its present state the machine consists of a pair of shears, formed of two spars about 70 feet long each, which are erected over a space previously prepared, by earth and stones rammed together, and covered by a platform of iron ballast. The anchor to be tested is then swayed up by a tackle as high as the shears will admit, by which its lower end is somewhat more than 50 feet from the iron platform; it is then stoppered with a slip-knot in a position called by sailors "a cockbill," and, on a signal given is detached from its place, and precipitated on the iron mass below. On Friday evening an old anchor was by this means broken in several pieces, and some of the iron ballast was likewise broken by the shock. But an anchor of more modern date, and which had been carefully prepared by a process of annealing, sustained the ordeal twice without injury. It is understood that this means of trying the anchors has been adopted in consequence of an accident occuring to an anchor of the *Canopus*, by which that ship narrowly escaped driving ashore. This must have occured in shoal water, and on very hard ground, as had the water been deep, and the ground moderately soft nothing but a very defective anchor indeed could have given way. The mode of testing now in question is so far effective that any anchor which has been subjected to it, and afterwards to the hydraulic pressure test, may be considered perfectly safe. The only objection to it is, that by it a good anchor, as well a bad one, may be spoiled.—*Nautical Standard.*

The Arctic Expedition.—One of the Hull whalers picked up a cask in Baffin's Bay in October, which had been thrown overboard by Sir J. Ross, and contained intelligence of the progress of the ships under his command. From it we learn that on the 28th of August last Sir James was at the mouth of Lancaster Sound, in lat. 73° 50′, lon. 78° 30′, and "all well." No accounts of Sir John Franklin. The cask was found on the 2nd of October, in lat. 68° 10′, long. 64° 30′, and had travelled 550 English miles along the south coast of Baffin's Bay in 35 days, or about 16 miles a day. But allowing for the detours which the cask must have made on the icy coast, the velocity of the current which bore it along was probably twice as great. Sir James, it may be remembered, sailed in April or May last, to inquire after the fate of Sir J. Franklin's expedition, which left England in the summer of 1845, and from which no authentic accounts have been received. The expedition was fitted out partly, like those of Parry and Sir John Ross, to search for a north-west passage, and complete the geography of North America—partly to make scientific observations. Three years and a half have now elapsed since it started, and the entire absence of all direct intelligence from it naturally creates uneasiness in the public mind, and alarms the friends of the adventurous navigators. To appease these feelings, Sir John Richardson was sent out in March, 1847, to Canada, with instructions to proceed by land to the southern shores of the Arctic Ocean, in hopes of obtaining some account of the expedition, either directly or through the Esquimaux. He was to take with him 4 boats and 20 men. For the same purpose, two ships, the Plover and Herald, sailed in January last for Behring's Straits, with supplies of provisions and marine stores, for the use of Captain Franklin if he should reach that quarter. There are thus three parties in quest of him, one proceeding by Baffin's Bay, one by Behring's Straits, and one by Mackenzie's River. Though so long a period has elapsed without tidings of him, nothing like a feeling of despair, we believe, exists in the minds of the best informed persons. His two ships, the Erebus and Terror, were built expressly for navigating amidst the ice, and are as strong as wood and iron can make them. He carried provisions with him for three years, which, by economy, could be made to serve for four; and the voyages of Parry and Ross show that with a sufficiency of food several winters can be spent safely and comfortably within the Arctic circle.—*Scotsman.*

Building Arts.

Art. VI.—SUMMARY OF THE COVENANTS CONTAINED IN THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(Continued from p. 269.)

MASONRY.

All the work to be put together in the soundest and most workmanlike manner; all parts being housed and fitted, and all joints secured with cramps, joggles, plugs, and other needful and proper articles. All horizontal joints to have one or more slate joggles, with mortices in upper and lower stones; the slate joggles to vary from 1½ to 2½ inches: the large stones of columns and pilasters of portico to have similar joggles of York stone, 4 by 4 by 4. The joints of columns and pilasters of portico to have milled lead cut and fitted, and laid to the extent of 77 cwt. 3 qrs. and 7 lbs. The carved pendants to modillions in Corinthian entablature to all parts except the face and returns of portico, to be cut out of separate stones, and secured and fixed with copper spindles, 6 inches long, run with lead. The masonry of tower, also, to have 16 similar spindles, 8 inches long; and the balustrades will require two others, 2 feet long. All the upright joints to be cramped with one or more cast-iron cramps, varying from 6 to 9 inches, let in and flushed and covered with Roman cement; and part of the upright joints, as will be directed, to have plugs run with lead.

To cut seventy-four 20-inch bevil sunk letters, in Roman capitals, in the frieze of the Corinthian order.

The granite is to be the best granite from the Fogging Tor, Penrhyn, or Aberdeen quarries, of a fine grain and even colour throughout, being entirely free from large crystals of quartz or felspar, as well as from redness or stains.

Every stone to be fine axed on the external face, so as to present a fair and perfectly even surface, at least equal to a sample now upon the ground, which has been approved by the architect.

The beds and joints to be full and square for their whole depths, particular care being taken to preserve the outer arrises, so that when the work is set it may be close and solid throughout, without any packing; and no joint is to exceed one eighth of an inch in thickness. The backs are to be thicknessed square with the beds, so as to present a fair surface against the brick backing.

The granite work throughout is to be laid on a thin bed of mortar, prepared as hereafter described, the face of the joints being pointed, and the rest grouted full with mortar.

The stones to be set with lewises and proper tackle; all the arrises and angles are to be very carefully kept, and the lines of mouldings and the mouldings, (which latter are to be, in all cases, worked out of the solid) are to be wrought to their true and proper form.

The mortar is to be composed of one measure of fine ground genuine Italian pozzolano, two equal measures of clean river sand, and one equal measure of good fresh burnt Dorking lime, mixed with water, and well worked to a proper consistency, and, in that state, ground with edge stones.

West Front.—The pedestal course to this façade, including the great pedestals to each side of steps to portico, will be executed with Fogging Tor granite; the great pedestals in three courses; top or surbase, 83 by 15; the end stones, 4 ft. 4 long; and stones under pillars, 5 ft. 1 long, and only one stone between pillars; the dies, 31 by 13 on each face; part of the inner face will be 19 by 13; the end stones to be 67 by 47 on bed; the plinth 49 by 21, to return inside only part of the length; the end stones to be 73 by 27 on the bed. The north and south flanks of pedestal to be also in three courses; surbase 27 by 15; die, 31 by 21; and plinth not moulded, 40 by 21, being 2 inches in height less than the great pedestals. The quoin stones of surbase will be 75 by 82 on bed; the quoin stones of dies, 34 by 36; and the quoin stones of plinths, 71 by 30 on bed.

South Façade.—The west quoin pedestal to be Fogging Tor granite, and to correspond in every respect with pedestal of the flanks of the west façade. The remaining pedestals will be of Penrhyn granite. The two pedestals to central pilasters will be in three courses; surbase in two stones, together 7 ft. 6 by 6 ft. 5 by 1 ft. 3; die in two stones, 7 ft. 0½ by 2 ft. 10 by 2 ft. 4; plinth in two stones, together 6 ft. 6 by 7 ft. 8 by 2 ft. 4. The plinth course to one will be 2 ft. 1 high only. The pedestals to the other two of the four central pilasters will be in three courses; surbase in two stones, 6 ft. 5 by 3 ft. 5. and 4 ft. 2 by 3 ft. 3, both 1 ft. 3 high; the die in two stones, one 7 ft. 1 by 2 ft. 10 by 2 ft. 7, and one 2 ft. 10 by 3 ft. by 2 ft. 7; the plinth in two stones, one 6 ft. 6 by 3 ft. 6 by 2 ft. 7. One of these pedestals will have the plinth stones 1 ft. 10 high, instead of 2 ft. 7. The eight other pedestals will be each in three courses; surbase 6 ft. 5 by 4 ft. 7 by 1 ft. 3; dies to four of them 5 ft. 7 by 2 ft. 11½ by 2 ft. 7; dies to the other four 5 ft. 7 by 2 ft. 11½ by 2 ft. 2. Eight plinths 5 ft. 9 by 4 ft. 3 and 2 ft. 0½ average height.

The east quoin under two whole pilasters and one semi-pilaster will also be in three courses; surbase 1 ft. 3 high in three stones, one 25 by 55, and two of them 82½ by 55; the die 1 ft. 9 high in two stones, one 39 by 36, one 62 by 48, and filled in with 14-inch granite, 6 ft. 11 long in three stones; the plinth 1 ft. 8 high, in four stones, one 24 by 21, two 57 by 18, and one 45 by 63.

Circular corners.—Four plain Penrhyn granite pedestals will be required, each in one stone, 39 by 54, and 52 high; the faces circular. The pedestals to the half pilasters of these circular corners are described with the pedestals of the other façades.

East Façade.—The Pedestals to this front will be of Penrhyn granite. The north and south quoin pedestals, including half pedestals under semi-pilasters of the circular corners, will be in three courses; surbase 5 inches thick in two stones, 71 by 38, and 19½ by 38; die in two stones, one 67 by 36, and 19 high, and one 39 by 36, by 26 high; plinth in two stones, one 72 by 42, and 27 high, and one 26 by 37, and 22 inches high. The pedestals under the two pillars in centre will be each in three stones; surbase 72 in. by 72 by 5; die 67 in. by 67 by 19; plinth 79 in. by 79 by 26. The pedestals to the other two pillars and quarter pilasters adjoining, will be—surbase 84½ in. by 72 by 5; die in three stones 19 in. high, one 67 in. by 26, one 41 in. by 34, and one 37 in. by 19; the plinth in two stones 2 ft. 2 in. high, one 79 in. by 39½, and one 52 in. by 68. The two other pedestals under pilasters will be each in three stones, one 71 in. by 38 by 5, one 67 in. by 36 by 19, and one 72 in. by 42 by 26.

North Façade.—The east quoin pedestal will be like the east quoin pedestal of south façade, but it will be of Aberdeen granite, and the plinth stones 1 ft. 8 inches high.

The west quoin pedestal will be Fogging Tor granite, and will be similar to north flank pedestal of the west front. The eight pedestals under piers will be each in three stones; surbase 62 in. by 32 by 20½ high; die 56 in. by 15, and 21 in. high to four of them, and 26 in. to four others; plinths 59 in. by 30½ and 21½ high. The dies of these pedestals to be 1½ inch thicker as herein described, and margins 5 inches wide are to be sunk round them 1½ inches deep, and the central parts finished rock-work. The double pedestals east and west quoins of centre, will be the same, excepting height of plinth, which in one is 30 inches, and in the other 40 inches. These will be in three courses each; surbase in two stones, one 77 in. by 55 by 15 and one 55 in. by 25 by 15; the die in two stones, one 72 in. by 36 by 21, and one 30½ in. by 36 by 21; the plinth in two stones, one 75 in. by 53. and one 53 in. by 27. The other four pedestals will also be each in three courses, and the same height as last, but the plinths will vary from 34 to 38 inches in height; surbase in one stone, 77 in. by 45; die in one stone 77 in. by 39; plinth in one stone 77 in. by 42.

All these pedestals to be moulded, as is shown in the drawings; and the mouldings are to be mitred and stopped against plinth. Plinths sunk out adjoining the shop fronts, and the pedestals to be sunk out, rebated, and back-jointed for those shop fronts, in some cases to be backed by brickwork, and in other cases to be left for plastering, The joints in beds to have York joggles, 3 by 3 by 2, with mortices sunk in both stones, and the joggles set in cement. Five hundred and twenty-four joggles in all will be required for this.

Provide and fix twelve piers in the great vault to carry arches, each in

one stone, 6 ft. 6 high and 2 ft. 3 square; and the faces to be plain axed, and the top bed sunk for skew-back. These piers to be Penrhyn granite.

To provide also of similar granite, and set them in basement walls, 84 granite springers, 33 in. by 27 by 13, sunk and plain axed to proper form, as will be directed.

To lay the open area with Peterhead granite, 7 inches deep, and 5 inches wide, all neatly dressed and sized, and laid in regular circular margins, as will be directed, and as shown in drawing No. VII.—to be laid on a bed of concrete 6 inches thick, floated to a fair surface, and covered with a layer of Claridge's patent asphalte one inch thick, and with a bed of sand 3 inches thick, and grouted with lime and sand. This pavement to be laid with currents, as will be directed, and to be trimmed and back-jointed to the cast-iron gutter round area, and to six iron frames, for which the contractor is to allow the sum of 10*l.* prime cost, and to fix them with the paving. It is intended that the Turkey stones saved from the fire, as far as they are fit, shall be laid in this area in regular circular margins intermixed with the Peterhead granite; and the contractor shall make an allowance by way of deduction for the saving of the cost of part of the Peterhead granite, which will not then be required.

The contractor to execute granite plinths to great piers in east area, and other works in granite, of the prime cost value of 200*l.*

Inside Paving, Steps, and Staircases.

Basement.—The great cellar, its recesses and passages in the basement, to be laid with 3-inch tooled York paving, the coal vaults with 2½-inch self-faced paving. All other parts of the basement not otherwise covered to be laid with 2½-inch tooled York paving. This paving to be laid on concrete (to be provided and laid by bricklayer) in regular courses, neatly notched to piers, close jointed, and bedded and flushed with mortar. The paving to be fair back-jointed to flooring which meets it.

Ground Story.—To pave the two entrances and staircases of the Royal-Exchange Assurance offices with 3-inch Portland. Fix in the southern entrance six Portland moulded steps 10½ inches clear width from riser to riser, with 2½-inch nosing in addition, and 6 inches clear rise, and rebated and back-jointed. The middle pieces of the three bottom steps in long lengths. The landing at the top of these steps to be formed of three pieces of 6½-inch Portland, with moulded and mitred nosings to correspond with steps. Fix Portland plinths under two of these landings, 1 ft. 6 high, and 2 ft. bed. Fix round side and two ends of opening for staircase to basement Portland curbs 12 by 7, back-jointed to paving, and to form top step of the basement staircase. To pave the entrance of the London-Assurance offices with 4-inch rubbed York landing paving, and fix similar curbs, but of rubbed York, round opening of staircase to basement. Fix in entrances to great public vault, each side of tower, 7-inch rubbed York landing, pinned in 7 inches, and the joints joggled and run with lead; the outer edges fair, and rebated for steps above and below.

The entrance to the unappropriated offices on the north side to have similar paving and curb to that which has been described for the staircase and entrance of the London-Assurance offices. To pave the two entrances and staircase of the Banking-house in north-west angle, with 3-inch Portland, and fix Portland curb, 12 by 7, to side and two ends of opening for basement staircase. Fix in doorway from staircase to Banking-house two steps, and in the north entrance four steps, to be moulded, and to be 10 by 6½ net.

To fix to outer entrance doorway to Lloyd's entrance and staircase 8-inch rubbed and back-jointed Craigleith step in three stones; the middle stone 88 inches by 39, and each end stone 36 by 26; mortices to be cut for door frame and for two scrapers, and the joints to have double plugs and lead. To pave the staircase with 3-inch Cragleith paving in courses bedded and jointed in mortar, and form fair edge next opening for basement stairs.

Fix to the shop and office fronts in the three façades, and in east area, 115 feet 1 inch cube Portland, with all labour, in plain plinths and steps, part in long lengths, and cut mortices for wood frames and sockets for bolts, the joints being plugged and run with lead. Fix also to the same fronts 155 feet lineal of York curb 9 by 9, and 11 feet lineal of similar curb to circular corners, the whole jointed, with mortices cut for door-posts; and fix, in addition, eight tooled York bases 9 in. by 9 by 6, with a mortice in each.

Mezzanine Story.—Three-inch rubbed York paving to strong room of the Royal-Exchange Assurance offices. Similar paving to retiring-room adjoining Lloyd's staircase.

One-pair Story.—All parts of this story, not floored or otherwise covered, to be paved with 3-inch Portland paving, bedded and jointed with fine mortar, on solid brick spandrils.

Fix to Basement doorways steps as follows:—Two York tooled steps, 14 by 6 in Royal-Exchange Assurance, one long ditto with the joints plugged and run with lead, and two others 4 ft. 3 in long. To fix to doorways on Lloyd's basement one step 27 in. by 6 in., and two steps 31 in. by 6. To fix in basement of Banking-house three steps 14 in, by 6; and in basement of the unappropriated offices one long step 14 ft. by 6, with two joints plugged and run with lead. Fix to doorways to thirty-three rooms under shops thirteen steps 5 ft. 6 in. by 14 by 6, and seventeen steps 9 ft. 6 in., by 1 ft. 2 by 6 in., with two joints in each plugged and run with lead. Fix also two steps 27 in. by 6 in doorways of great vault.

Fix to doorways, Ground Story, steps as follows;—Rubbed York steps, 30 in. by 4, and 6 ft. 6 long, to doorways from west entrance to Ambulatory; also similar steps, 4 ft. 4 long, 12 ft. by 7 to the four entrances in east entrance archway under tower.

Fix two sets of rubbed York jambs, head, and sill for iron door, 9 ft. by 6 in. with joggled joints, and rebate 2 in. by ½, and grooved for deal linings in the offices of the Royal-Exchange Assurance, Fix a similar set of jambs, head, and sill, with similar work, in the unappropriated offices. Fix also a similar set in the offices of the London Assurance, and in the Banking-house, and two sets in Lloyd's rooms, making seven sets in all. They are each to be in four stones, and from the Park Spring quarries. Cut all mortices for door frames throughout, and all bolt holes, and all holes for boxes of spring hinges. All the steps to be back-jointed, and to have tooled ends, and all the ends to be let in to the brickwork, and to be well pinned and made good with cement.

To fix to the two windows in basement, south side, tooled York sills, 19 in. by 6, and to the windows of rooms under shops in east area two York sills, 19 in. by 6, and four ditto 28 in. by 6; and fix to window of water-closets in basement of Banking-house York sill, 9 in. by 6, and 7 ft. 4 long. Fix to six back windows on second story Portland sills, 9 in. by 6. All these sills in York and Portland to be sunk and throated with fair ends, and made good to brickwork.

(To be continued.)

Specification of the work required for the Clock, and Machinery for the Chimes.

Situation.—The clock will be placed in the tower; and all the space therein, from the level of the floor marked A in the section (which is just above the level of the main Corinthian cornice), will be appropriated to the clock, with its machinery, bells, &c.

Dials.—There will be four dials of copper, each nine feet in diameter, with the numbers and divisions of hours, minutes, and seconds enamelled thereon. The hour and minute hands of copper. These dials will be placed as shown in the section, and must be fixed to the stone-work in the most secure and workmanlike manner.

Clock.—The machinery of the clock may stand at any level that may be suggested, as the timber floor on which it is to stand may be placed at any level that may be required. It will be seen by the section, that the first story of the tower, above the great cornice before spoken of, is a chamber thirteen feet square, the height being twenty feet; that above this level

occur the clock faces; and that the top of the tower affords an octangular chamber nine feet in diameter by a height of about twenty-five feet.

Machinery in Works of the Clock.—The machinery of the clock must be constructed in strict accordance with the following conditions:

First, That the escapement is to be dead beat, or something equally accurate; the recoil escapement being expressly excluded.

Secondly, That the pendulum must be compensated.

Thirdly, That the striking machinery is to be so arranged that the first blow shall be accurate to a second of time.

Fourthly, That the wheels shall be so arranged that every one, or at least every important wheel, may be taken out separately for the purpose of cleaning, repairing, or reinstating.

Fifthly, That it have a going fusee.

Sixthly, That the main supports or frames of the machinery be of cast iron, well finished, painted, and bronzed.

Seventhly, That there be a wrought iron barrel for the chimes, arranged for four tunes. That two of these tunes shall be played alternately each hour on the week days, the machinery shifting the tune; and two on Sundays also, at the alternate hours, shifting the tune by the machinery. The change of tunes, however, from the week days to the Sundays, and from the Sundays to the week days, may be adjusted by the person who will have to attend to the winding, adjusting, and setting the clock.

Bells.—The bells will be nine in number; and these bells, with their hangings and fixings, will be provided by the committee; but all hammers, levers, joints, and rods, for the hours, quarters, and chimes, must be provided by the clock-maker.

Weights.—It is desired that the fall of the weights shall not descend below the level of the floor A, unless it is considered of great importance that it should be otherwise, which must be distinctly stated and the reason pointed out.

CONDITIONS OF THE CONTRACT.

Workmanship.—All the workmanship must be of the most accurate and perfect kind, adopting all modern improvements. The clock-maker will also be required to submit his plans to the judgment of the Astronomer Royal, Professor Airy, and the architect; and the work is to be executed to their satisfaction.

Payments.—The payments are to be made as the work proceeds, in such sums and at such times as the architect may consider reasonable; provided always that the clock shall be fixed and finished completely in its place, leaving a balance of not less than 20 per cent. of the amount of the contract, which is not to be claimed or claimable until three months after the completion of the work; and the clock-maker is only to be entitled to receive such balance on the joint certificates of Professor Airy and the architect that they are satisfied with the execution of the work, and with the performance of the clock in all respects.

Changes, whether in increase or diminution of cost.—Should there be any changes in the work or in its machinery, or any parts thereof, causing additional labour or expense, or on the other hand diminishing the labour and expense, such changes are only to be adopted on the authority of the committee as communicated in writing by the architect; and such changes, whether of addition or diminution of value, are to be referred to the arbitrement and decision of Professor Airy, whose judgment is to be final and binding on all parties.

Time for completion of the work.—The tower will be ready for the clock-maker in March, 1844; and the whole work of the clock and all its machinery is to be ready so that it may be fixed and finished, complete in alll respects, in the months of April and May following, and completed at the latest by the last day of the latter month.

Scaffolds.—The clock-maker must not depend on the use of the scaffolding of the builder for fixing the dials or hands, or any other works, but must construct any scaffolding he may require for those purposes; he must also clear it away, and be liable to the cost of making good any damage to the roofs, carving, or any other works, which may be caused thereby.

Tender.—The tender is to state clearly and distinctly the general character and nature of the work proposed, the kind of escapement intended, and the nature of the compensation for the pendulum. The amount is to be stated in one total sum for the clock and its machinery, clock-faces, hands, barrel for chimes, hammers, rods, and other works required for the completion of the work in all respects, including the fixing or mounting, together with the wooden cases for the clock weights and for the pendulum, and the cases for the machinery of the clock.

The following explanations and conditions are to form part of the contract, as explained by a letter addressed to all parties, dated 27th July, 1843.

The dials and hands are to be of copper. The hands to have brass backs. Dials to be painted black; the figures and hands gilt with the best gold. The dials to be as little convex as possible.

The clock to be an eight-day clock.

There are to be no second-hands externally; but the clock is to show the seconds inside. The quarters are to strike on four bells; and the weight of the bell for the striking of the hours will be about one ton.

If it be required, the weights can fall about twelve feet below the level of the floor A, shown in the section.

The contract will be prepared at the expense of the committee, and the contractor will be required to give security for the due performance of the work, and for its being finished and fixed completely within the time specified.

ART. VII.—ESTIMATES.

(Continued from p. 269.)

In the two former schedules of prices, the permanent fence posts and railing, sleepers, permanent iron rails, keys and spikes, were provided by the company; such was also the case in the three schedules that follow, which are those of subcontractors; but in addition here the whole plant was supplied to them, including waggons, with new cast iron wheels, axles, coupling chains, &c.; all timber, cranes, &c.; delivered near the works.

	No. 3. £ s. d.	No. 4. £ s. d.	No. 5. £ s. d.
The price of permanent fencing, including the fixing of the posts and railings, and forming and planting the cope and ditch, for a single fence per lineal yard	0 0 6	0 1 0	0 1 6
The price of excavation not being in rock, when the lead does not exceed ½ mile, per cubic yard ...	0 0 9½	0 0 11½	0 0 10
The price of excavation not being in rock, when the lead exceeds ½ mile, but does not exceed ¾ of mile, per cubic yard	0 1 1½	0 1 0½	0 0 10
The price of excavation not being in rock, when the lead exceeds ¾ mile, but does not exceed 1 mile.[19] (Engine power found by company) per cubic yard	0 1 2½	0 0 10	0 0 10

[19] Engine power not found for No. 3.

The price of excavation in rock, when the lead does not exceed ½ mile, per cubic yard	0 1 4½	0 1 4	0 0 11
The price of excavation in rock, when the lead exceeds ½ mile, but does not exceed ¾ of a mile, per cubic yard	0 1 6	0 1 5	0 0 11
The price of excavation in rock, when the lead exceeds ¾ mile, but does not exceed 1 mile.[19] (Engine power found by company,) per cubic yard	0 1 8	0 1 2	0 0 11
The price of excavating foundations, including keeping them dry, per cubic yard	0 2 0	0 1 10	0 1 4
The price of brickwork in bridges, arches, and culverts, set in mortar, per cubic yard	1 0 0	0 16 0	1 1 6
The brickwork in bridges, arches, and culverts, set in in cement per cubic yard	1 7 0	1 1 0	1 6 6
The price of block in course, set in mortar, measuring 18 inches from the face, when the stone is obtained in the excavations, at per cubic yard	0 18 0	0 18 0	0 18 0
The price of block in course, set in mortar, measuring 18 inches from the face, when the stone is not obtained in the excavations, at per cubic yard	0 18 0	0 19 6	0 18 0
The price of rubble, set in mortar, when the stone is obtained in the excavations, per cubic yard ...	0 10 0	0 7 0	0 6 6
The price of rubble, set in mortar, when the stone is not obtained in the excavation, per cubic yard ...	0 10 0	0 8 0	0 6 6
The price of solid rubble, set in mortar, uncoursed, all the joints well squared, when the stone is obtained in the excavation, per cubic yard	0 12 0	0 13 0	0 10 0
The price of solid rubble, set in mortar, uncoursed, all the joints well squared, when the stone is not obtained in the excavations, per cubic yard	0 12 0	0 14 6	0 10 0
The price of ashlar, fair tooled, when the stone is obtained in the excavations, at per cubic foot ...	0 1 8	0 1 8	0 1 6
The price of ashlar, fair tooled, when the stone is not obtained in the excavations, at per cubic foot ...	0 1 8	0 1 9	0 1 6
The price of ashlar quoins to skew arches, fair tooled beds, with chamfered joints, margin draught, punched face, when the stone is obtained in the excavations, per cubic foot	0 2 6	0 2 1	0 2 4
The price of ashlar quoins to skew arches, as before, when the stone is not obtained from the excavations per cubic foot	0 2 6	0 2 3	0 2 4
The price of ashlar quoins to square arches, fair tooled beds, with chamfered joints, margin draught, punched face, when the stone is obtained from the excavation at per cubic foot	0 2 2	0 1 9	0 2 1
The price of ashlar quoins, to square arches, as before, when the stone is not obtained from the excavations, per cubic foot	0 2 2	0 1 11	0 2 1
The price of ashlar string course and coping, fair tooled when the stone is obtained from the excavations, per cnbic foot	0 2 2	0 2 1	0 2 0
The price of ashlar string course and coping, fair tooled, when the stone is not obtained from the excavations, per cubic foot	0 2 2	0 2 3	0 2 0
The price of ashlar imposts to skew arches, fair tooled, when the stone is obtained from the excavations, per cubic foot	0 2 3	0 1 8	0 2 0
The price of ashlar imposts to skew arches, fair tooled, when the stone is not obtained from the excavations, per cubic foot	0 2 3	0 1 10	0 2 0
The price of ashlar imposts to square arches, fair tooled, when the stone is obtained from the excavations, per cubic foot	0 2 0	0 1 10	0 2 0
The price of ashlar imposts to square arches, fair tooled, when the stone is not obtained from the excavations, per cubic foot	0 2 0	0 2 0	0 2 0
The price of block in course in arches, set in mortar, when the stone is obtained from the excavations, per cubic yard	1 14 0	0 18 6	1 6 0
The price of block in course in arches, set in mortar, when the stone is not obtained in the excavations, per cubic yard	1 14 0	1 1 0	1 6 0
The price of parpoints in arches, set in cement, per cubic yard	1 7 6	1 1 0	1 6 0
The price of parpoints in arches, set in mortar, per cubic yard	1 2 0	0 15 6	1 1 6
The price of fence walling, when the stone is obtained from the excavations, per lineal yard	0 5 0	0 8 6	0 6 0
The price of fence walling, when the stone is not obtained from the excavations, per lineal yard ...	0 5 0	0 10 6	0 6 0
The price of dry rubble walling, when the stone is obtained from the excavations, per cubic yard ...	0 3 6	0 4 9	0 5 3
The price of dry rubble walling, when the stone is not obtained from the excavations, per cubic yard ...	0 3 6	0 6 0	0 5 3
The price of flag fencing, 6 feet long, 3 inches thick, set 18 inches in the ground, secured by clips, per lineal yard	0 6 9	0 6 0	0 6 0
The price of concrete, in any situation, per cubic yard	0 7 6	0 8 0	0 7 6
The price of clay puddle, in any situation, per cubic yard	0 2 0	0 1 9	0 1 9
The price of building brick culverts, including foundations, fronts and wings, viz :—			
18 inches diameter, per lineal yard	0 17 0	0 15 0	0 15 0
2 feet diameter, per lineal yard	1 7 0	1 1 0	1 1 0
3 feet diameter, per lineal yard	2 2 0	1 12 6	1 10 0
4 feet diameter, per lineal yard	3 5 0	2 9 0	2 5 0
5 feet diameter per lineal yard	5 5 0	3 10 0	0 0 0
The price of building stone drains, with flag tops and bottoms, viz :—			
9 inches × 6 inches	0 6 0	0 3 0	0 3 0
12 inches × 12 inches	0 9 0	0 4 6	0 4 6
12 inches × 18 inches	0 12 0	0 7 6	0 8 0
18 inches × 24 inches	0 17 0	0 11 0	0 15 0
2 feet × 2 feet 6 inches	1 3 0	0 18 0	1 0 0
The price of flags, 3 and 4 inches thick laid on grouting, at per yard super	0 4 3	0 4 0	0 4 0
The price of solid block in course in piers, with cutwaters, fair tooled, per cubic foot	0 1 4	0 1 0	0 1 6
The price of bearing piles, larch, beech or Memel, 12 inches mean diameter, hooped, and heads levelled and prepared for platform, driven under 20 feet, per cubic foot	0 4 9	0 0 0	0 4 0
The price of sheet piling, Dantzig or Memel, tops levelled, and bolted to waling, driven under 12 feet, per cubic foot	0 3 9	0 0 0	0 0 0
The price of 3 inch planking, Memel laid complete, per cubic foot	0 4 0	0 0 0	0 0 0

[19] Engine power not found for No. 3.

The price of 4 or 6 inch planking, memel laid complete, per cubic foot	0 3 9	0 3 6	0 3 6
The price of memel waling timbers, bolted to pile heads, complete, at per cubic foot	0 4 0	0 3 9	0 3 9
The price of cast iron girders, Eaton Hodgkinson's pattern, fixed complete, at per ton	8 10 0	9 0 0	0 0 0
The price of cast iron mouldings attached to cast iron girders, fixed complete, at per ton	9 0 0	9 12 6	0 0 0
The price of cast iron ornamental hand railing, fixed complete, at per ton	9 0 0	9 12 6	0 0 0
The price of paved crossings for T. P. Roads, per square yard	0 4 0	0 3 0	0 3 6
The price of paved crossings for other roads, per square yard	0 3 9	0 3 0	0 3 6
The price of metalling the surface of diverted T. P. roads, per square yard	0 3 6	0 1 9	0 2 0
The price of metalling the surface of diverted other roads, per square yard	0 3 0	0 1 9	0 2 0
The price of asphalting arches, per square yard	0 1 9	0 1 6	0 1 6
The price of ballasting permanent way, per cubic yard	0 1 9	0 1 6	0 1 6
The price of laying a single line of way, per lineal yard	0 0 9	0 1 0	0 0 10
The price of pitched open side drains in excavations, per lineal yard	0 7 6	0 6 0	0 4 0
The price of setting up two gates, at level crossings, the gates being delivered by the company, per pair ...	1 6 0	1 1 0	1 1 0
Wages of excavators, per day	0 3 9	0 4 0	0 3 6
Wages of masons, per day	0 5 6	0 5 8	0 5 6
Wages of bricklayers, per day	0 5 9	0 6 0	0 5 6
Wages of carpenters, per day	0 5 0	0 5 0	0 4 6
Wages of smiths, per day	0 5 0	0 5 0	0 4 6
Wages of laborers, per day	0 3 9	0 3 6	0 3 6
Horse and cart with driver, per day	0 7 6	0 8 3	0 7 0

ART. VIII.—EXTRACTION OF COPPER FROM ITS ORES BY ELECTRICITY.

BY M.M. DECHAUD AND GAULTIER DE CLAUBRY.

The admirable researches of Becquerel upon the chemical actions effected under the influence of weak electrical currents, have opened a path destined to lead metallurgy to results of which we are even now unable to appreciate the full importance.

Having for their object the application of these actions to the extraction of copper from its ores, MM. Dechaud and Gaultier De Claubry have long been engaged in researches which they now consider sufficiently matured to command attention, being destined to effect a complete transformation of the existing processes. The following is a brief account of their results, reduced to the simplest form.

The extraction of copper from pyritous ores is divided into two series of operations, entirely distinct,—the roasting the ore, and the precipitation of the copper.

The Roasting.—This is effected in a reverberatory furnace, either by the direct conversion of the sulphuret into sulphate, by the sole action of the air, or else by another reaction of useful application, which consists in the transformation of the oxide of copper into sulphate, by calcining it with sulphate of iron, at a dull red heat, in a current of air, the iron being left in the state of peroxide.

Suitable washing extracts the sulphate of copper, which contains neither arsenic nor antimony, so that the most impure minerals, as the *fahlers*, will afford copper equally pure with the carbonates or oxides of copper, which contain no other metal.

The Precipitation.—The precipitation of copper from its solution requires, in the galvano-plastic processes, batteries, of which the cost is far too great to be employed in metallurgy. It has, therefore, been attempted to obtain the same effect without the use of exterior batteries. The principles upon which the apparatus depends are these:

If we place, one over another, two solutions, one of sulphate of copper, very dense, and the other of sulphate of iron, less dense, and in the first we place, a plate of metal, forming the cathode, and in the sulphate of iron a fragment of cast-iron, and then unite these two metals by a conductor, the precipitation of copper commences at once, and is completed in a longer or shorter time, according to the temperature, the concentration of the liquids, and the extent of the metallic surfaces. But as M. Bequerel has observed, the physical state of the copper undergoes great change as the liquid becomes weaker. We obviate this great difficulty by turning to profit the observation, that after some minutes' action, there exist four strata in the liquids; at the bottom we find the dense solution of sulphate of copper, then a less dense solution of the same salt which has been deprived of its copper by precipitation; next is sulphate of iron, become more dense by the solution of the cast-iron; and last, on the surface, the same salt in its original strength.

If, therefore, at the level of each of these strata, we arrange suitable apertures for the addition or removal of the liquids, in proportion as the chemical action goes on, we can easily preserve these liquids at uniform states of density, and thus the copper is always pure and in the same physical condition.

In the application of this process to metallurgy, the extent of surface of land required to precipitate a large quantity, becomes an important consideration; it is, however, easy to modify the form of apparatus, though preserving the same principle, so as to avoid this objection.

With this object, we arrange the liquids in vertical, instead of horizontal, layers; they are now to be separated by a diaphragm, very permeable to electricity, but not to liquids. Pasteboard answers perfectly for this purpose; it lasts for months, without any alteration, and the quantity of sulphate of iron which penetrates into the sulphate of copper is still too small to affect the operation. The apparatus, is, therefore arranged in the following manner:

A chest of wood, lined with lead or some suitable mastic, contains the solution of sulphate of iron; through an opening near the top, we add the liquid until the proper degree of density is attained, while through a lower opening the saturated solution is allowed to escape.

Into this chest we plunge a number of cases, made of a frame having its ends and bottom formed of iron-plate coated with lead; the sides are made of a sheet of paste-board. The strong solution of sulphate of copper enters through a pipe near the bottom and escapes in its weak state through an opening at the top. *In* each case is placed a sheet of *leaded* iron; *between* each case and outside the end ones, are plates of cast iron. Separate rods connect each plate with the common conductor, which is supported above the apparatus. Two large reservoirs of constant levels, receive the solutions and furnish them continuously. We adjust once for all the densities of the liquids, and then the apparatus works on for whole months without requiring any kind of attention. The most convenient strength of the solution of copper which escapes from the apparatus is from one-fourth to one-half of a saturated solution. The copper is precipitated on both sides of the sheet of metal forming the cathode.

As the paste-board prevents the *immediate* contact of the two liquids, we effect this by making small holes through its upper edge, taking care that they are some distance above the highest parts of sheets of metal forming the cathode; the sulphate of iron can thus float above the solution of sulphate of copper, and the vertical apparatus now fulfils all the conditions of the horizontal one.

At a temperature of 20° cent. 68° F., one square metre (10·73 sq. ft.) of surface will receive as much as 1 kilogramme (15,444 grs.) of copper in twenty-four hours.

The precipitate copper is pure, and is always in the same physical condition; the sheets obtained are fit for immediate working under the hammer, or to pass through the rolling mill; four or five passings through this gives the metal a density of 8·95. We, therefore, avoid all the operations required in the common process to reduce it from the form of bars to that of sheets. The manufacture presents no difficulties, requires no refining, and gives no scoria. In a regular manufacture, as much as 75 per cent. of the copper has been obtained in the form of sheets, the remainder being precipitated, partly in pure fragments, and partly in powder of cementation. The authors consider as a metallurgical result, at the lowest 50 per cent of the copper in sheets, 25 per cent. in fragments, which only require fusion to be reduced into bars or plates; and 25 per cent. in powder, requiring subsequent refining.

The question as to the applicability of galvanic action to the extraction of copper appears to be reduced to the simplest possible form. It is hardly necessary to remark that electrotypes, on the largest scale, can be thus obtained.—*Journal of the Franklin Institute.*

GILBERT'S APPARATUS FOR FACILITATING THE EXTRACTION OF TEETH.

The operation of tooth extracting has, up to the present time, been regarded by most persons, as a very unpleasant one; and certes, it is no wonder, since the structure and arrangement of the teeth in the mouth are of that character, that to withdraw them therefrom frequently requires the exercise of much physical force; but the unpleasantry that really does accompany this operation, has hitherto been greatly augmented by the incompleteness of the apparatus used to effect it; for although the operation, considered mechanically, is but a simple one—the application of a lever to withdraw the tooth from its socket—yet the peculiarities of the case seem to have baffled the ingenuity of all until now, albeit the propriety of extracting the tooth in a vertical direction, has been fully comprehended, and the necessity of having a suitable fulcrum for the lever to act upon to effect this acknowledged; yet nothing better has been proposed than an instrument having its fulcrum placed in the jaw; and thus the practice of extracting teeth by wrenching or side movement continued, and the "key" maintained itself in plenitude of the tendency of this system to splinter the jaw, and cause great pain and inconvenience to the patient.

Thanks to Mr. Gilbert, who has invented and patented an apparatus which supplies the desideratum in a simple and effectual manner, the extraction of teeth will be deprived of most of its terrors. The apparatus used by Mr. Gilbert, as exhibited by his specification, consists in affixing to an operating chair (which is of peculiar and suitable character) a vertical rod or standard of metal, near the point where the head reclines, fitted with a brass boss so as to slide freely thereon, and carrying an arm of about eight or nine inches long, having a socket, into which fits the rest or fulcrum employed by the operator. By the different movements of these parts the rest may be brought into any position within its range, or turned to assume a different angle. The several parts are fixed by means of set screws, by which they are firmly held in the proper position. The instrument forming the fulcrum is made parallel so as to receive a small slide which projects about an inch on one side. When one of the back teeth is to be drawn, the patient being seated in the chair, the rest is introduced between the jaws, and there fixed by the set screws, and if the tooth to be extracted be from the under jaw, the ordinary forceps is placed over the rest which acts as a fulcrum for the forceps, thereby giving the operator the necessary leverage to enable him to extract the required tooth very easily, and in a nearly vertical direction. When the tooth to be drawn is in the front, it then becomes necessary to place a small slide on the fulcrum, which is kept entirely out of the mouth, the sliding-piece bearing on the teeth beyond that which it is intended to extract, the forceps are then applied in the same manner as before explained. In extracting the teeth of the upper jaw, the position of the forceps is altered, being in that case above instead of below the rest. The rest or fulcrum and slide, which are both of metal, are covered with some soft fibrous material, to avoid injury or inconvenience to the patient. Mr. Gilbert, the patentee, also includes an improved instrument to be used instead of the ordinary "key."

We have to remark, that Mr. Gilbert, who is a surgeon, has operated most successfully with the aid of this apparatus, and that it has received the commendations of very high authorities.

ART. IX.—LIST OF ENGLISH PATENTS.

GRANTED FROM 23rd NOVEMBER TO THE 4TH DECEMBER, 1848.

Thomas Masters, of Regent Street, for certain improvements in apparatus for making ærated waters, and in apparatus for charging bottles, and other vessels, with gaseous fluids; also improvements in bottles and other vessels, and in apparatus for drawing off liquids: in securing corks or stoppers in bottles or other vessels, and in taps and vent pegs. Patent dated Nov. 18, six months.

Thomas Cullen, of the City of London, gentleman, for improvements in apparatus for steering ships and other vessels. Patent dated Nov. 18, six months.

John Juckes, of Rosamond Cottage, Fulham, gentleman, for improvements in furnaces and fire-places. Patent dated Nov. 18, six months.

Alexander M'Dougal, of Longsight, Manchester, chemist, and Henry Rawson, of Manchester, agent, for improvements in the manufacture of sulphuric acid, chlorine, and sulphur. Patent dated Nov. 21, six months.

John Oliver York, of 24, Rue de Madeleine, Paris, engraver, for his invention of improvements in the manufacture of metallic tubes. Patent dated Nov. 21, six months.

William Hood Clement, of the city of Philadelphia, for certain improvements in the manufacture of sugar, part of which improvements are applicable to evaporation generally; also improved apparatus for preparing the cane trash to be used as fuel. Patent dated Nov. 21, six months.

Henry Newson, of Smethwick, near Birmingham, for an improvement or improvements in trusses. Patent dated Nov. 23, six months.

Hugh Bell, of London, Esq., for certain improvements in ærial machines, and machinery in connection with the buoyant power produced by gaseous matter. Patent dated Nov. 23, six months.

Christian Schiele, of Manchester, mechanician, for certain improvements in the construction of cocks or valves, which improvements are also applicable for reducing the friction of axles, journals, bearings, or other rubbing surfaces in machinery in general. Patent dated Nov. 23, six months.

Peter Llewellin, of Bristol, brass and copper manufacturer, and John Hammons, of the same place, brass-founder, for improvements in the manufacture of cocks or valves for drawing off liquids. Patent dated Nov. 23, six months.

Henry Archer, of Great George Street, Westminster, gentleman, for improvements in facilitating the division of sheets or pieces of paper, parchment, or other similar substances. Patent dated Nov. 23, six months.

Frederick Bromwell, of Mill Wall, Poplar, engineer, and Samuel Collet Homersham, of the Adelphi, gentleman, for improvements in feeding furnaces with fuel. Patent dated Nov. 23, six months.

Pierre Armand Lecomte de Fontainemoreau, of Skinner's Place, Sise Lane, for certain improvements in the process of, and apparatus for, treating fatty bodies, and in the application of the products thereof to various useful purposes. Patent dated Nov. 25, six months.—(Communication.)

John Goucher, of Woodsetts, in the West Riding of York, agricultural machine and implement maker, for a machine for threshing corn and other grain. Patent dated Nov. 25, six months.

John Lane, of Liverpool, and John Taylor, of Liverpool, engineers, for improvements in engines, boilers, and pumps, in rotary carriages, in propelling vessels, in the construction of boots, in extinguishing fire, and in brewing. Patent dated Nov. 29, six months.

Edward Shunck, of Rochdale, in the county of Lancaster, chemist, for improvements in the manufacture of malleable iron, and in treating other products obtained in the process. Patent dated Nov. 29, six months.

William Rothwell Lomax, of Banbury, in the county of Oxford, engineer, for improvements in machines for cutting hay and straw into chaff, and for cutting other vegetable substances. Patent dated Nov. 29, six months.

Jonah Davies, and George Davies, of the Albion Iron Foundry, Staffordshire, ironfounders, for improvements in steam-engines. Patent dated Dec. 2nd, six months.

Robert Burn, of Edinburgh, for an improved roller gin, used in separating the seed from cotton. Patent dated Dec. 2nd, six months.

Francis Hastings Greenstreet, of Liverpool, engineer, for certain improvements in hydraulic engines. Patent dated Dec. 2nd, six months.

John Armstrong, of Edinburgh, brass founder, for improvements in constructing water-closets. Patent dated Dec. 2nd, six months.

George Armstrong, of Newcastle-upon-Tyne, Esq., for certain improvements in steam-engines. Patent dated December 2nd, six months.

Frederick Collier Bakewell, of Hampstead, gentleman, for improvements in making communications from one place to another, by electricity. Patent dated Dec. 2nd, six months.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, merchant, for certain improvements in machinery or apparatus for winding, balling, or spooling, thread, yarn, or other fibrous materials. Patent dated Dec. 2nd, six months.

Robert Nelson Collins, of Oxford-court, Cannon-street, druggist, for certain improved compounds to be used for the prevention of injury to health under certain circumstances. Patent dated Dec. 2nd, six months.

James Taylor, of 15, Furnivals Inn, gentleman, for improvements in propelling ships and other vessels. Patent dated Dec. 2nd, two months.—(Communication.)

John Henderson Porter, of No. 2, Adelaide-place, London-bridge, engineer, for an improved mode of applying corrugated iron in the formation of fire-proof floors, roofs, and other like structures. Patent dated Dec. 2nd six months.

John Daley, of Northampton, ironfounder, for certain improvements in the construction and arrangements of stoves for cooking and other purposes. Patent dated Dec. 2nd, six months.

Thomas Drayton, of Regent-street, practical chemist, for improvements in silvering glass and other surfaces. Patent dated Dec. 4th, 1848.

James Young, of Manchester, manufacturing chemist, for improvements in the preparation of certain materials, used in dyeing and printing. Patent dated Dec. 9th, six months.

John Gardner, of Wokingham, engineer, for improvements in girders for bridges and other structures. Patent dated Dee. 9th, six months.

William Ironside Tait, of Rugby, in the county of Warwick, printer and bookseller, for an improved method or methods of producing outlines on paper, pasteboard, parchment, *papier mâché*, and other like fabrics. Patent dated Dec. 9th, six months.

Andrew Lamb, of Southampton, engineer, and William Alloft Summers, of Milbrook, in the county of Southampton, engineer, for certain improvements in steam-engines and steam-boilers, and in certain apparatus connected therewith. Patent dated Dec. 9th, six months.

John Tutton, of 20, South Audley-street, Grosvenor-square, mechanic, for certain improvements in the construction and arrangement of certain parts of buildings. Patent dated Dec. 9th, six months.

Christopher Nickels, of the Albany Road, Camberwell, gentleman, for improvements in the manufacture of gloves, and articles of dress and furniture. Patent dated Dec. 9th, six months.

William Palmer, of Sutton-street, Clerkenwell, in the county of Middlesex, manufacturer, for improvements in the manufacture of candles. Patent dated Dec. 9th, six months.

George Lawrence Lee, of Holborn, lithographer, for improvements in producing ornamental designs. Patent dated Dec. 9th, six months.

Edmund Hartley, of Oldham, in the county of Lancaster, mechanic, for certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton, and other fibrous substances. Patent dated Dec. 11th, six months.

Analysis of Patents.

JEAN NAPOLEON ZERMAN, of Greenwich, Kent, Captain in the French Navy, *for improvements in ships and other vessels.* Patent dated February 8, 1848.

This invention consists in forming ships and other vessels without a keel, parts of the bottom being made flat or nearly so, with a longitudinal channel or passage formed at the bottom in place of the keel, which he states will cause the vessel to draw less water, and take more hold of the water. The claims are in substance as above stated.

JACOB BRETT, of Hanover-square, Middlesex, *for improvements in electric printing and other telegraphs.* Patent dated February 8, 1848.

This invention, like all others on the same subject is exemplified by a specification of great length, and numerous sheets of drawings, and leaves no choice but to present the claims, as follows. The invention is claimed, first, (which part is an improvement upon Mr. Brett's patent of November, 1845) as regards the improved arrangement of the escapement, also the modes described of constructing the type-wheels, and giving motion thereto; with the mode of applying the governing apparatus, for effectually ensuring the operation of printing, likewise the arrangement of parts for sounding the bells; and the arranging the letters, marks, and figure, according to order for their frequent use upon the type-wheels, and upon the dial-plate, and arranging the pins upon the barrel of the composing machine or key-board, and the arrangement of the letters upon the quadrant of the communicators, and the construction of the communicators. Secondly, the arrangement of apparatus called the writing telegraph, whereby by electro magnetic agency, certain marks or characters are produced upon paper or other suitable material, by means of a pen or other sufficient marker; also a modification of the same by means of the passage of electricity through paper or fabrics chemically prepared; and likewise the use of paper prepared with plumbago or having its surface rendered conducting, in a suitable manner, on which the communication is printed or marked by means of any conducting material; also the use of metallic plates or metalized surfaces for the same purpose. Thirdly, the construction of apparatus, called the electric-circuit-regulator, for the purpose of throwing any one, or more, of the stations, out of the circuit at pleasure. Fourthly, the mode described of indicating the position of a locomotive on a railway. Fifthly, the combination of permanent magnets with electro-magnets, for increasing the power of the permanent magnets. Sixthly, the construction of apparatus for the purpose of making and breaking the connection with a main battery, for increasing the power required for making a signal at a distant place. Seventhly, the use of metal types, for composing sentences or communications which are to be transmitted by means of the electric-printing telegraphs. Eighthly, the mode described of combining and applying permanent magnets within hollow coils of wire, (sometimes with electro-magnets) for obtaining an increase of power at a distance from the main battery employed. Ninthly, the mode described of increasing the power of permanent magnets, through coils of wire surrounding them. Tenthly, the mode described of suspending bar magnets or magnetized needles for the purpose of facilitating the action of a current of electricity. Eleventhly, the use of magnets having two north poles and two south poles, for the purpose of electric telegraphs.

CHARLES RITCHIE, of Aberdeen, Scotland, Engineer, *for certain improvements in locomotive and other engines.* Patent dated March 2, 1848.

This invention will be found described at another page of the present number of the Artizan.

JOHN HOUSTON, Stepney, Middlesex, Surgeon, *for improvements in obtaining motive power by the aid of atmospheric air and in obtaining combustion.* Patent dated March 8, 1848.

The nature of this invention may be briefly given from the claiming part of this specification, as consisting in the mode of constructing engines to be worked by means of compressed and heated air, steam being employed to supply the compressed air, which is then heated in steam boilers and after employed to impel a piston in a cylinder.

WARREN DE LA RUE, of Bunhill-row, Middlesex, Manufacturer, *for improvements in machinery used in the manufacture of cardboard and pasteboard.* (Being a communication.) Patent dated March 8, 1848.

By this invention instead of cardboard or pasteboard being made by sticking several thicknesses of paper together by means of a hand-brush, it can now be manufactured by making use of an arrangement of mechanism, whereby the paper cut to the proper size is taken up, and properly pasted by the action of suitably arranged pasting cylinders, having circular brushes or other appliances thereon, revolving in paste troughs, the machinery depositing the sheets properly pasted and ready to receive the finishing operations, on a suitable table.

Claim is made to the arranging and combining mechanical parts into a machine, so as to apply paste to short sheets of paper, and also to facilitate the accumulation of such sheets of paper in the manufacture of cardboards and pasteboards.

WILLIAM EXALL, of Reading, Berkshire, *for certain improvements in thrashing machines, and in steam boilers, engines, and other apparatus for driving the same, which apparatus is applicable to driving other machinery, part of which improvements are a communication and the remainder is his own invention.* Patent dated March 8, 1848.

This invention has reference in the first place to the improvement of thrashing machines, and consists in forming the breasting or concave of wrought iron bars, either case-hardened or otherwise, so separated or detached as to be susceptible of separate adjustment; this improvement being applicable to cast or wrought iron bars, or bars made of any suitable material. Secondly, the mode of adjusting the concave or breasting (whether the bars be separate or combined in sets) by means of two sets of grooves or slots, one crossing the other, one set being in a fixed, and the other set in a moveable frame, or by means of two moveable plates having eccentric grooves, the movement of the whole of the bars being effected by one movement of the hand lever. Also in a moveable mouth-piece attached to the upper part of the breasting. Thirdly, as regards steam engines, the improvements consist in arranging two steam cylinders, at an angle, working on to the same crank pin, exactly as in Mr. Brunel's patent. To diminish the room occupied, there are two piston-rods to each piston, and the connecting rod dips down between them, there being a dish cast in the cylinder and piston to make room for the cross-head (This appears to be an unhappy combination of Mr. Brunel's patent and Mr. Rennie's plan for some direct-action marine engines.—ED. ARTISAN.) Fourthly, the mode of adjusting the eccentrics which work the valves or slides (without stopping the engines) by means of a rack acted upon by a pinion contained within the shaft, this giving motion to another pinion that gears into the toothed ring or arc on the side of the eccentric. Fifthly, as regards Hero's engine, the invention consists in the introduction of the steam into the arms through a hollow neck or collar of prepared india rubber, with metal washers, making the revolving joint steam tight, together with the partial or total closing of the emission apertures, and the reversion of the motion of the engine, by means of slides or valves receiving motion through the hollow axle or neck of the engine. Sixthly, the combining a vertical cylindrical boiler and fire-box, having radiated horizontal flues, with a flue surrounding the boiler, bounded by the external casing of the boiler, and also the placing the surface of the fire-bars somewhat below the bottom of the boiler, for the admission of air on all sides of the fire. Seventhly, as regards the improved horse gearing for driving machinery, the enclosing the wheel within a casing, (a cylindrical form being preferred) which casing has fixed to it at the top, a toothed rack or ring, into which gear, one or more toothed wheels attached to the underside of a revolving lever-holder, or cover to the casing, and working and driving a pinion fixed upon an upright central shaft, so as to cause the said shaft to revolve faster than the lever-holder or cover. Eighthly, the application of compressed wood to the manufacture of the teeth of wheels, so that when the teeth are forced into the recesses of the periphery of the wheel, the subsequent expansion will retain them securely therein. Ninthly and lastly, making dove-tailed or other suitable shaped grooves extending across the face, to receive teeth of a suitable shape, formed of wood which has been previously compressed. The patent right is claimed substantially as above stated.

GEORGE LLOYD, of Stepney, Middlesex, Iron Founder, *for certain improvements in furnaces and blowing machines, and improvements in engines and machinery for driving the same, which improvements are also applicable to other purposes where motive power is required.* Patent dated March 8, 1848.

This invention may be described to consist, first, in a new arrangement for employing the waste heat from an ordinary cupola to heat a steam-boiler; also, to a combination of fire-bars and fire-bricks in a furnace, in which all the gaseous products of the fuel may be consumed, by passing over the heated fire-bricks, a supply of atmospheric air being admitted through suitable tubes. An improved form of fire-bar is described, consisting of two parts, the object being to be able to renew the face of the bar when burnt out, and thereby save wasting the whole of the bar, as is ordinarily the case. The second part of the invention relates to blowing machines. An improved shape for the blades of fans is described, and a new form of blowing machine consisting of a series of bellows, placed round an octagonal case, the said bellows to be worked by eccentric rods in much the same way, that the floats of a feathering paddle-wheel are worked. The next claim consists in applying apertures of increasing area to the arms of certain descriptions of rotary engines. The fourth improvement consists in using bearings of plumbago for spindle of a fan.

The last improvement consists in applying gutta percha to the periphery of riggers driven by straps.

FRANCIS WHISHAW, of Hampstead, Middlesex, Civil Engineer, *for a certain manufacture of pipes of earthenware, pottery, and glass, and of certain applications and arrangement thereof.* Patent dated March 8, 1848.

This invention has for its object the providing of pipes, channels, or ducts of any convenient form, suitable for the passage of the wires of electric telegraphs in a state of insulation, and other purposes where such arrangements are desirable, and consists, Firstly, in the formation of any required number of pipes, channels, or ducts, within one and the same mass, or external surface of earthenware or pottery, the shape and arrangement of such pipes, channels, or ducts, and the form of the external surface being adapted to the circumstances required. Secondly, in the mode of manufacturing pipes of earthenware and pottery where they are required of an uniform surface, and consistency of material, whether as a cluster of pipes, or channels with the same mass, or singly in the usual manner. Thirdly, in certain combinations and arrangements of pipes of earthenware, pottery, and glass. Fourthly, in a mode of combining pipes of earthenware, pottery, or glass, so as to render them air-tight at their junctions, which is effected by making use of a cement composed of asphalte or of gutta percha.

GEORGE COODE, of Haydock Park, Lancashire, *for an improved method or methods of distributing over land, liquids and substances in a liquid or fluent state, and certain improved apparatus or machinery employed therein.* Patent dated March 11, 1848.

This invention consists in certain apparatus for distributing manure, and its application to such distribution. These apparatus are termed respectively the parallel, the radial, and the diametral distributor, but are all constructed upon the same general principles, and have first a delivery pipe, which is a long tube perforated all over with holes, or in certain parts only, in order to deliver the liquid or liquid matter, such tube being either of some rigid material or of some flexible material, inclosed in a rigid framework or cradle, and second, they have a flexible hose for feeding the delivery pipe.

ALEXANDER ALLIOTT, of Lenton Works, Nottingham, Bleacher, *for improvements in spring apparatus, and in balances, also in breaks, and in the means of working breaks.* Patent dated March 11, 1848.

This invention is summed up in the claiming part of the specification as consisting in first, the addition to and combination with the breaks of railway carriages of the retarding apparatus described; also the employment, in manner described, of compressed air or exhausted air for the purpose of throwing the breaks in or out of action with the peripheries of the wheels, when such breaks derive their action from the axles of the carriage wheels. Secondly, the improved weighing machine described, in so far as regards the wheelwork, by which the weights upon the platform are ascertained by an index hand upon a dial-plate. Thirdly, the improved spring platform weighing machine described, in so far as regards the arrangement whereby the platform is always preserved at the same level, whatever the weight upon the platform. Fourthly, the modification of the same described, wherein the deflection of a needle, by means of an electric current, is employed to indicate the exact point of balance when the weight is on the platform Fifthly, the improved weighing machine wherein the dial is made to indicate at places at a distance from the platform, the weight upon the platform. Sixthly, the improved spring apparatus, in so far as regards the employment of compressed air in combination with a piston having an universal action, whether applied to railway carriages or otherwise. Seventhly, the two modifications described of the above, wherein the spring is produced by a vacuum. Eighthly, the construction of buffer spring apparatus wherein both buffers are made to sustain at the same time an equal pressure.

JOHN HOSMER, of New Cross, Surrey, Surveyor, *for improvements in apparatus for supplying water and for cleansing drains and sewers.* Patent dated March 16, 1848.

This invention has relation to the flushing or flooding of drains in order to cleanse the same from their impurities, for which purpose, a cistern is combined in two parts, or two separate cisterns, with the means of supplying water-closets thereto in such manner, that the contents of one compartment of the cistern, or of one of the cisterns, shall be emptied suddenly by the action of a float, to flush the drains or sewers connected therewith, and by a second and a third arrangement, water is supplied to a cistern in such manner that when it becomes sufficiently full, a part of the water shall be let out, to flush the drains or sewers.

John James Cole, of Lucas-street, Middlesex, *for certain improvements in steam-engines.* Patent dated March 22, 1848.

The nature and objects of this invention are thus summed up in the claiming part of this specification :—First, as consisting in the construction of high pressure and expansion cylinder beam engines, as regards the placing the one cylinder above the other, and also in such other parts of the engine as are necessary for such change of position. Secondly, the construction of direct acting double cylinder engines, so far as regards the placing the connecting-rod down between the two cylinders, and also the system of levers by which the parallelism of the piston rods is maintained without the use of guides, and equalizing the power from the piston rods. Thirdly, the construction of double-acting air pumps, as regards the use of slide-valves instead of clock valves, as generally used. Fourthly, the construction of expansion slide-valves, as regards the use of laps to the valves, and the means of adjusting their position for regulating the degree of expansion. Fifthly, the construction of safety valves, as regards the secondary or supplementary means for lifting the valve when it sticks fast or otherwise ceases to act.

[This gentleman does not seem to possess a very great amount of inventive genius. His double cylinder beam engine is neither more nor less than Mr. Sims' patent; and as regards the substitution of slide-valves for the ordinary hanging valves of air pumps, see p. 224 of Artizan Treatise on the Steam Engine, where the same plan is suggested and fully described.—Ed. Artisan.]

William James Dailey, of Lambeth, Surrey, Lithographer, *for certain improvements in machinery for propelling.* Patent dated March 22, 1848.

These improvements in machinery for propelling, relate to a sub-marine paddle placed at the side of the vessel. A small paddle-wheel is placed in a horizontal position at a point in the vessel as low as convenient, in order to work in water of as much density as possible. Three-fourths or thereabouts of this paddle is within the vessel, the remainder projecting into the water, that is the length of the floats. The inner part of the wheel is enclosed within a water-tight case nearly fitting it. A proper stuffing box being provided for the shaft or axle of the propeller. This shaft, at the part within the case, has a boss, wherein the ends of the rods carrying the rods are stepped, so as each to turn freely on its axis, proceeding radially at points equally divided. On the shaft at a lower joint is a circular disc, with a rising flange at the circumference, through which pass the before-mentioned rods, forming their principal bearing and supporting them in their radial position. On this flange a cover is placed, but not secured to it, the flange rotating with the shaft, whilst the cover remains stationary The underside of this cover has two raised surfaces described, round the centre, one passing $\frac{3}{8}$ round, while the other passes about $\frac{1}{2}$ round, one being of smaller diameter than the other. The ends of both these projections being inclined in order to run level with the underside of the cover. Two pieces of metal are attached to each of the blade-spindles, forming a cross, and are placed in a position so as to come into contact with the inclined projections on the cover, and cause each blade when at that point to turn partially on its axis. The other produces another part of a turn, both being equivalent to $\frac{1}{2}$ of a revolution. By this means each float, as it emerges from the side of the ship, turns and presents its broadside to the water, and on completing that part of its revolution that lies outside the vessel, it moves the other quarter turn, causing it to feather, during that part of the revolution, within the case, obviating the waste of power hitherto attending propellers of similar character. The patent right is claimed as regards the general character of the invention, substantially above described.

George Armstrong, of Newcastle-upon-Tyne, Engineer, *for an improved water pressure engine.* Patent dated May 11, 1848.

This arrangement of engine consists of two cylinders placed at right angles or thereabouts as in Brunel's engine, but with the piston-rods passing through the bottom of the cylinders, instead of the top, by which a longer connecting rod is obtained. The cylinders are supported by an arched frame, which, being cast hollow, forms the induction and eduction passages for the water. The admission of the water is regulated by a slide-valve to each cylinder, set back to back, and worked by ordinary eccentrics, and of such construction as to neutralize the pressure on their faces. The ports in this engine are to be made much larger than for steam, and to compensate for the incompressibility of the water, relief valves are attached, which admit water or allow it to escape, as required. A diaphragm of vulcanized india-rubber is also proposed to be placed at top and bottom of the cylinder, or on the piston, inclosing a space, to approach the elasticity of steam. An improvement on the slide-valve for this engine is proposed, consisting of the ordinary piston-valves, in equilibrium. The claims are—First, the arranging of the cylinders at an angle to each other, equal to, or approaching a right angle, and the inverted position of them, as applied to a hydrostatic engine. Secondly, he claims the varieties of slide-valves hereinbefore described, and which are equally applicable as pump-valves, especially in such cases as require the action of the pump to be very rapid. Thirdly, he claims the application of what is called vulcanized india-rubber, or other suitable material, in hydrostatic engines, to compensate for the non-elasticity of the water, as herein described. Fourthly, the arrangement of the relief-valves as herein described.

COURT OF QUEEN'S BENCH.

Tuesday, December 12,

(Sittings at Nisi Prius, at Westminster, before Mr. Justice Wightman, *and a Special Jury.)*

THE QUEEN V. SMITH AND OTHERS.

The evidence for the defendants in this case closed this morning.

Mr. Cockburn then made a most forcible address to the jury in reply, on behalf of the Crown.

Mr. Justice Wightman summed up, stating that this was a proceeding to repeal letters patent, which had been granted by the Crown to Mr. Junius Smith, in the year 1843, on the ground that the Crown had been deceived; and that if all the facts had been shown to have been previously known, these letters patent would not have been granted. The invention was said to be that of a foreigner, communicated to Mr. Smith. If any part of the invention claimed by a party as his invention was not new, although the remainder was new, the whole patent would be void. A patent privilege was good for one art or invention which was a combination of several known arts or inventions, and it might be a valid patent, though the thing used was well known, if the novelty consisted in dispensing with any one part of the previous machine. The patent of Mr. Smith was for certain improvements in machinery for sawing wood, and Mr. Smith divided his improvements into two parts; the first part was for an improved mode of sawing timber in curves; and the second part was for bevilling timber. The prosecutor alleged that the Crown had been deceived in these respects,—that the invention was not new, that it was not useful, and that it was not in the manner suggested in the petition communicated by a foreigner at the time the petition was signed. In 1841, Mr. Smith petitioned for a patent. On the 3rd of June, 1843, Mr. Smith took out letters patent for certain improvements in machinery for sawing wood, and by his specification he stated that his invention consisted of a novel mode of sawing wood by machinery in curves and bevels. The claim was the mounting the saw in an interior frame, supported within a saw gate, and enabled to slide laterally, and of guiding the saw with a fork guide lever. The most complicated part was the bevilling, which was contrived by three processes—the sawing process, the process for turning the log, and the process determining the angles to be given to the bevilling. The learned judge having gone through the whole case, left twelve questions to the jury, who gave such answers that the verdict was directed to be entered for the Crown on several of the issues, and for the defendants on the remainder; the latter with leave for the Crown to move to enter a verdict.

This case commenced on Thursday, the 7th inst., and most scientific evidence has been adduced on both sides, and some beautiful working models have been exhibited in court.

The Societies.

SOCIETY OF ARTS, WEDNESDAY EVENING, 22nd NOV. 1848.

Continued from p. 279.

The advantages which the author considers his plan to possess over other plans, are that of enabling bridges of any span to be built without a centering, whereby a great saving is effected; also, in enabling a flatter roadway to be obtained, while a higher waterway is insured than can be obtained by any plan in which the arch, springing from the pier, is made use of.

The paper concluded with a detailed account of the comparative cost of constructing bridges on the various plans hitherto used, and also of the weight of metal employed.

The thanks of the meeting were presented to Mr. Gladstone for his communication.

Several models illustrative of Mr. Richard Roberts' new principle of mechanics were exhibited, and their peculiarities and mode of construction, and advantages, described by the Secretary.

December 6th, 1848.—J. L. Ricardo, Esq., M.P., in the chair.—Sir William Curtis, H. Pickton, J. L. Hancock, G. F. Morrell, A. S. Jee, T. Musgrove, S. Mawe, E. Varnish, J. E. Errington, and T. Perry, were elected members.

Mr. T. B. Jordan read a paper on some further improvements in his Carving Machinery. The three great improvements which Mr. Jordan has effected in his carving machine consist:—1st. In the construction of what he terms a vertical machine. The peculiarity of this arrangement is, that it enables him to carve blocks of stone of any required size for architectural or decorative purposes, without having to move the weight of the block, as would be the case if it were placed on the horizontal bed of his first machine. The cutting drills are by the vertical machine brought in contact at right angles to the face of the stone, the stone itself being placed on a chuck or centre, upon which it is made to revolve so as to afford the necessary facility for bringing every portion of the surface into contact with the drill.

2ndly. In applying mathematical instruments on the floating tables to the production of carved mouldings from drawings without the use of models. This he does by having the cutting edges of the drills made in the form of one half of the section of the moulding to be produced.

3dly. In affording the means of producing a reverse copy of any required pattern, so that the two curves on a chair back or other piece of furniture, can be cut from a single mould at one and the same time.

This he effects by dividing the upper floating table into two parts, and fixing a centre under the machine, and between the two floating tables on this centre is a fixed lever which is connected at each end by means of iron rods to the floating tables, so that whatever motion is given to the right hand table is exactly copied in a reverse direction by the left hand table; this is the case only so long as the radii of the two arms of the fixed lever are exactly alike, but by altering the length of either arm, a fourth improvement is effected, as the inventor is enabled to compress a pattern so as to produce a narrow panel from an original of much greater breadth.

A model of the horizontal machine and diagrams of the vertical machine, with specimens of work cut in each of the same, were exhibited.

The thanks of the meeting were presented to Mr. Jordan for his communication.

Owing to the lateness of the hour at which the discussion on the above paper closed, J. A. Leon, Esq. C.E., requested that the reading of his paper on high pressure steam generators might be postponed, which was accordingly done.

November 29th, 1848.—I. K. Brunel, Esq., in the chair.—A paper was read by Joseph Glynn, Esq., F.R.S., on Hydraulic Pressure Engines, and the employment of high falls of water acting by their weight or pressure upon a piston working in a cylinder, to produce a reciprocating or alternating motion.

"It appears" observed Mr. Glynn, "that in the year 1769 this subject had been brought before the Society of Arts by Mr. Smeaton, the celebrated engineer whose construction of the Eddystone Lighthouse has since served as a guide in similar works.

Mr. Smeaton had seen a column of water brought to bear by its pressure on the piston of a cylinder, in a manner similar to the action of atmospheric pressure on the piston of steam engines as they were made at that time, before Mr. Watt's improvements took place, the cylinders being then open at the top and the piston forced downwards by the pressure of the atmosphere above.

This ingenious application of water pressure was the invention of Mr. Westgerth, a mechanic employed at the lead mines of Sir Walter Blacket, in the county of Northumberland.

Mr. Smeaton with a desire to advance merit wherever it might be found, brought the subject before the Society of Arts, and obtained for the invention a premium of fifty guineas, he also wrote an excellent description of the engine, which was printed in the society's transactions, and illustrated the paper by drawings.

Owing to the great improvements subsequently made in the steam engine by Mr. Watt, water engines of all kinds were thrown into abeyance, and the water pressure engine, remained unemployed in England, until its use was revived by Mr. Trevithick who was distinguished by the invention of locomotive engines to be used on railways in or rather upon the tramways of his time.

Mr. Trevithick erected several water pressure engines, and in 1804, he made one of them for a lead mine in Derbyshire which is still working well in the Allport Mines, near Bakewell.

In 1841, the proprietors of the mines by the advice of Mr. John Taylor, resolved to erect a very powerful engine of this kind to clear the mines from water; this was made by the Butterly Company under Mr. Glynn's direction, and set to work early in the following year. It is one of the most powerful and efficient engines of this kind hitherto made; the work it performs is equal to 70 per cent. of the theoretic power of the water fall.

The column of water in this instance is 132 feet high, the stroke of the piston is 10 feet, and the diameter of the cylinder is 50 inches, consequently the pressure on the piston is equal to a weight of 50 tons. This engine is capable of making 7 strokes per minute, without any concussion in the descending column.

An excellent model of this engine, now in the museum of Economic Geology, was made by Mr. Jordan, whose admirable invention of machinery for carving in wood, has established his reputation for mechanical skill.

The water pressure engine although neglected in England, has been extensively used in Germany and drawings of some of the best German engines were exhibited to illustrate the paper.

A lengthened discussion followed the reading of the paper, in which Mr. Jordan suggested a means of overcoming the concussion hitherto so objectionable in the working of all engines of this class, by using two cylinders, and merely diverting the current of water from one to the other instead of stopping it. Mr. Glynn also stated the situations in which he considered hydraulic engines could be advantageously employed and in which it would be impossible to make use of any class of water wheel. He also described an ingenious application by Mr. Armstrong of hydraulic power in the case of a crane used on the quay at Liverpool.

The thanks of the meeting were presented to Mr. Glynn, for his communication.

Mr. Staite and Mr. Petrie were present and exhibited their Electric Light, and showed the prismatic ray, and the ray concentrated by means of a lens. A lengthened discussion ensued as to the peculiar form of the shadow from the flame of a candle and the band of light which surronnded it.

The thanks of the meeting were presented to Mr. Staite and Petrie, who promised on an early evening to submit a paper on the two leading features of the invention, viz., rendering the light permanent, by means of a self-regulating magnet apparatus, also rendering the system economical by allowing only so much of the current to pass through the electrodes as it developed in light, and also to make a statement as to the cost of producing and maintaining the light.

Mr. C. Ruding submitted a paper on Mr. L. B. Piatti's compressed air atmospheric railway and a model of the tube, valve, and piston were exhibited. This will be found described at page 191, of our last volume.

The thanks of the society were presented to Mr. Ruding, and the meeting adjourned.

December 6th, 1848.—T. Webster, Esq. F.R.S. in the chair.—Mr. N. Holmes read a paper on the present state of Electricity as applied to Telegraphs. Mr. Holmes in bringing the subject forward, stated that it was his intention only to consider the principles of the best known forms of existing telegraphs. After giving a short history of the subject, prior to Volta's discovery of the voltaic current in 1800, overcoming the difficulties presented by the use of free electricity, he dated the progressive advancement of the science from Oersted's grand discovery in 1819 of the rotatory influence exercised by an electric current upon a magnetic needle, which

was immediately followed by that of Arago's in the formation of the electro-magnet. The introduction of the telegraph into this country took place in the year 1837, at which time many persons were engaged in the practical carrying out of the idea, but it was not until Professor Wheatstone's researches in the more theoretical portion of the science, that the requisite perfection was obtained. The telegraphs at this time were classified into two great divisions. Those of a mechanical nature, and others depending upon the direct action of the current, either by induction upon a magnetic bar producing deflection, or by the decomposition of certain chemical solutions. The objections to mechanical telegraphs, he stated, were too great to render them fit for railway or commercial purposes, although as many as 2000 signals have been given consecutively without error, by the author's (Mr. Holmes') improved instruments. The only railway in this country out of the 2000 miles of telegraph laid down, upon which they have been adopted, is the South Devon, and they were there used to give the signals for starting the fixed engines in connection with the Atmospheric system. After alluding to the numerous variety of printing telegraphs and alarums, Mr. Holmes exhibited his new signal in place of the old clock-work bell, producing the sound by means of an air whistle. In considering the second division of the subject, the various errors in the old form of needle instruments were pointed out, and the different improvements made, first by the introduction of his diamond instrument, now working at all the commercial stations in England, effecting an enormous decrease in the battery power required; and again in his new form of helix, further reducing the helical resistance in the instrument, a point also of great importance. In speaking of the Chemical telegraph recently perfected by Mr. Bain, many of the errors were pointed out, particularly those of resistance and want of rapid reciprocity. In cases of errors in reference to the insulation, it was stated that the exposed wires extending over the lines in this country, were in a very imperfect state; damp, moisture, and other circumstances frequently causing delays and interruptions, not excepting the street work of the Metropolis, which was based upon a fundamental error, that of enclosing one conductor in another improperly protected. As a means of improving the insulation, the plan of encasing the wires in a non-conducting substance from end to end, was brought forward, and some very beautiful specimens exhibited. The subject was closed after briefly noticing the derangement the telegraphs were liable to receive from lightning and the influence of magnetic storms; and the modes hitherto adopted to counteract these phenomena were shown to be very inadequate for the purpose. The paper was illustrated by a very comprehensive series of diagrams.

The thanks of the meeting were presented to Mr. Holmes for his communication.

LIVERPOOL POLYTECHNIC SOCIETY.

The last monthly general meeting of this society for the present year, which was adjourned from Monday to suit the convenience of his worship the Mayor, was held on Thursday evening, at the Royal Institution, Slater-street. Mr. Wm. Bennett, the President, occupied the chair, and was supported on the right by the Mayor, and Mr. C. F. Salt, the Secretary.

Mr. Grantham then introduced his paper on the landing stage, and in doing so, divided the subject of these improvements into three distinct propositions.

First.—To provide one floating-stage, as large as can be admitted into the Queen's Graving Dock, namely, 400 feet long, and 45 feet broad, to which both large and small steamers may be admitted.

Secondly.—To make two stages, each 200 feet long, connected together, one for the large steamers and one for the small.

Thirdly.—To fill up the small basin at the Prince's Pier, in which the present slip is situated.

In proceeding to describe the first plan, he stated that the floating-stage being of such dimensions that it could be placed in a graving dock, he preferred making it like an ordinary vessel; it was to be of iron, to be strengthened by two longitudinal bulkheads, and seven transverse ones, all of iron, thus dividing the vessel into twenty-four water-tight compartments. It was to have a rising floor and a hollow keel, into which all water would drain, so as to keep the vessel perfectly dry. It was to be covered by a four-inch deck, slightly covered. Round the outside would be a strong tender or rubbing piece of timber, with massive stauncheons let into iron sockets on the outside of the vessel. The stauncheons at one end of the stage would project ten feet above the deck, with strong spurs at the back —these are intended for the large sea-going steamers. This vessel would require no less than 490 tons weight to depress it one foot, and would draw about two feet; its projection above the water would be such that passengers, carriages, and goods could be landed from the ferry-boats without any difficulty. In this respect the present stage is defective, being much too high for small steamers.

The mode of mooring the stage is quite new, and has met the decided approval of practical men. Mr. Grantham proposes to construct three large iron beams, about seventy feet long, and one of each of which is to be secured to the top of the pier by a ball and socket joint; while the lower end will rest on the gunwale of the stage, acting against powerful springs, lying flat on the deck, and similar to those used in railway stations to check trains. There are three spring-cables or transverse chains from both ends, crossing each other within the length of the stage, thus not interfering with the navigation of the river, except as preventing vessels running between the stage and the pier; and as these chains will be attached to the upper part of the pier, and work in the same plane with the booms, the action of both will be uniform, and not require any alteration in the length of the chains, and thus remove all necessity for winches or other obstructions on deck, and save great labour to the men.

The head of the stage will be placed about a hundred feet further from the George's Dock Basin than the small Egremont stage, thus removing a just source of complaint respecting the present dangerous state of the entrance to the basin.

The bridge, by which the stage would be approached, would be of a light and elegant description, and situated on the pier where a crane now stands, running at an angle of about forty-five degrees to the centre vessel, by which means a greater length of way, and consequently easy incline is secured. The approach to the pier will be most convenient, and the turn to the bottom of the bridge will render it safer for carriages and heavy carts than if the bridge were at right angles to the stage.

It is proposed that large and commodious platforms, or gangway stages, on wheels, should be provided, to be in readiness for sea-going steamers of different heights.

The second plan, in its principal features, is similar to the first, but on a more extensive scale. In this case it is proposed to construct two floating-stages, each of 300 feet in length, connected by a hinged platform; the upper one to be adapted to small vessels, and the other to large sea-going vessels. The bridge and system of mooring would be the same in both cases; but for the latter plan a small additional foot-bridge is proposed to take passengers direct from the northern stage to the Prince's Parade. This plan would have the great advantage of preventing all confusion with the large and small steamers.

Mr. Grantham had submitted working drawings of his plans to respectable builders of this town, and had received tenders from them, by which he was enabled to state that, if the work was undertaken in the present low state of the iron market, the first plan would be executed for a sum not exceeding £20,000, and the second for a sum not exceeding £30,000. He had taken the opinion of builders, also, as to what such a work would have cost two years ago, or might cost two years hence. One stated twenty per cent., another thirty per cent. more. Taking, therefore, twenty-five per cent. as the mean, the estimates are £5,000 less in the first case, and £7,500 in the second, than they would have been two years ago.

He now described his last proposition, viz., to fill up the small basin at the Prince's Pier. He did not wish this to interfere with the merits of the stage. He only desired to show, that as one of the principal objects for which it was used would be superseded, and the advantages so great, he felt strongly called upon to urge its removal.

A long discussion followed, in which the Mayor took part.—*Liverpool Mail.*

COMBINED VAPOUR ENGINE.

A new engine has been exhibited at Messrs. Horne's, 114, Whitechapel, styled by its inventor, the Combined Vapour Engine, the main object of which is to produce as much power as possible, at the lowest possible outlay.

In low pressure steam-engines it is well known that the steam, after it has performed a single operation, in either elevating or lowering the piston, passes off from the cylinder to be condensed. It is in this process of condensation that the inventor of this new engine thought that there was great room for economising outlay. In being condensed the steam is deprived of its heat, but the process is one of simple deprivation, the heat being turned to no account whatever. The object of this invention is to turn this heat to account, thus making the steam perform the double operation of raising or depressing th episton, and of generating in its process of condensation a new motive power. The world may be a little surprised to hear that for this purpose chloroform has been called into requisition, this valuable substance being thus made contributive to painless operations in more ways than one. The construction of the engine, and the mode in which the object sought for is gained, are as follow:—

Enclosed in the same box are two small upright cylinders, distinct from and independent of each other. The piston in the left-hand cylinder is worked by steam, which is supplied to it by means of an iron pipe, connecting the valves with the boiler. Contiguous to this cylinder is another box, perfectly air-tight, and from which the air has been withdrawn as much as possible. In this box are a great many tubes, distinct from each other, containing chloroform, the whole quantity contained in them being from 20 to 30 pounds in weight. The steam, after raising or depressing the piston in the left-hand cylinder, passes not into a simple condenser, but into this air-tight box, filling the vacuum which exists between the box and the tubes. The extreme volatile qualities of the chloroform enable it at once to avail itself of the heat which is yet latent in the steam, in doing which a portion of it is immediately converted into vapour. The steam being thus deprived of its heat, of course condenses, but not, as we have seen, until it has parted with its heat to some purpose. The vapour of the chloroform, which is being constantly produced, from the constant admission of hot steam into the air-tight box cotaining it, passes, by means of an iron tube, to the right-hand cylinder, the piston of which it alternately raises and depresses, as the steam operates upon that of the left-hand cylinder. The vapour, having done its work, passes into another iron box beside the right-hand cylinder, where it is condensed, and then returned in its original shape to the tubes in the other box. The steam in the left-hand cylinder is thus, by turning its heat to account in condensing it, made actually instrumental in working two cylinders instead of one, so that it produces double the power that it otherwise would produce. When working, the pressure of the steam used was from three to five pounds to the square inch, whilst that of the vapour which it produced, in parting with its heat, was about 12 pounds to the square inch. Here was an aggregate pressure of 16lbs. produced by an outlay sufficient to produce from 3lbs. to 5lbs. pressure of steam. The saving of fuel which this effects must necessarily be great. The inventor himself says, that including the supply of chloroform necessary to substitute for any waste which may occur, the saving will be about 50 per cent. in the working cost of the engine. His waste, after working the engine for four months, and using during that time about 30lbs. of chloroform, did not much exceed 6lbs. That which he now uses costs from 8s. to 10s. per lb., but a material is in course of preparation which will answer his purpose equally well, and which will not exceed in price 10d. per pound.

This invention is amongst the numerous and important discoveries of the day. The object in view seems to be to maximize power, and at the same time to minimize outlay.

LIGHT RAILWAY PASSENGER ENGINES.

(From the *Morning Herald.*)

On the 9th instant, the first long trip was made with a class of locomotive, which, in connection with a carriage attached and fixed to the same frame, is considered by some practical men to be the one thing necessary for an economical mode of working much of the branch traffic of the country—a species of railway trade that has, *per se,* sadly disappointed the anticipations of the majority of railway directors. The engine, or rather the engine carriage, in question, is the *Fairfield,* and has been constructed by Mr. Adams, of the Fairfield Works, near Bow, for the Bristol and Exeter Company, who purpose working with it the traffic of their Tiverton branch. The engine itself weighs above five tons, and is attached to the carriage both transversely and longitudinally by bolts, so that the two run together upon one frame. The engine has a 4 feet 6-inch driving-wheel, an 8-inch cylinder, and a 12-inch stroke. She has an upright boiler, her heating surface, including 25 feet of fire-box, is 235 feet, and she keeps steam very well at 100 lb. pressure. The entire length of the engine and carriage is, we believe, 40 or 41 feet, and the distance between her leading (viz. her driving) wheels and the trailing wheels, 28 feet. The centre and trailing wheels run loose on their axles, which also run loose on their journals. The carriage is a composite one, with a first-class compartment affording accommodation for 16, and a second-class compartment for holding 32 persons.

The tender is in front of the driving-wheels, and holds about 220 gallons. The coke is carried in a box attached to the front of the carriage.

The trip made yesterday was from Paddington to Swindon and back. The number of guests was 18, but the second-class department was weighted so as to make the load taken equal to the full complement of passengers. Among those who made the trip were—Mr. M'Gregor, the Chairman, and Mr. Smale, one of the Directors of the South Eastern Company; Mr. Bruce, the Chairman of the East Anglian Company; Mr. Farey, C.E.; Mr. Roney, the Secretary of the Eastern Counties Railway; Mr. D. Gooch, the locomotive superintendent of the Great Western Railway; Mr. Samuel, the resident engineer of the Eastern Counties; Mr. Adams, the patentee; Mr. A. Sturrock, the superintendent of the Swindon locomotive works of the Great Western line; Mr. Hjorth, the inventor of the electro-magnetic engine; Mr. Reynolds, who carried out the whole of the details for the construction of the engine; and several other gentlemen.

The weather was extremely unfavourable, a stiff side wind prevailing all the way down to Swindon. In addition to this, the "little passenger engine" laboured under the disadvantage of a leak at the mouthpiece of the boiler. As the leak was inwards, it tended slightly to damp the fire. A drizzling rain fell almost throughout the trip, but as the driving-wheels have four or five tons upon them, there was very little chance of their slipping.

In the journey down, the driver, Alexander Hindmarsh, a picked man from the Eastern Counties, and who worked the engine admirably, was obliged to slacken his speed over several of the girder bridges, as there was some doubt whether the tank and framing, which are not more than nine inches from the rails, would clear the timbers. He was also obliged to slacken for several miles, by a goods train being ahead. This slackening afforded abundant opportunity of testing the starting and stopping capacity of the engine; and, as will be very naturally supposed, the little engine behaved remarkably well under the test. She brought up in 150 or 200 yards from 30 to 35 to 6 or 8 miles per hour, and got into her speed again within a quarter of a mile.

The maximum speed going down was 38.3 miles per hour, up a gradient of 4 feet per mile. The consumption of coke, with the heavy wind and all the drawbacks invariably attendant upon the working of a new engine, was, we understand, 14 lbs. per mile.

At Swindon the fire was drawn, and the leak in the mouthpiece of the boiler greatly lessened.

The speed from Swindon to Paddington was very good. The greater portion of the trip was run at an average speed of upwards of 43 miles per hour, and the maximum velocity down 5 feet per mile was 49.3 miles per hour. The distance from Slough to the ticket platform at Paddington, about 17½ miles, was run within 30 minutes, including the time lost in slackening for upwards of a mile in approaching the platform. Mr. Gooch rode upon the engine throughout the down and up trips.

We understand that the consumption of coke in the up-journey was from 11 to 12 lb. per mile. Mr. Samuel, the resident engineer of the Eastern Counties Railway, under whose direction the 22 cwt. "*Express*" used upon that railway by him for inspecting the permanent way was built, and who has given much attention to the question of light engines, is of opinion that he will be able to work the *Fairfield* at 7 lb. of coke per mile. We think he underrates the quantity that will be consumed.

In stating the average maximum velocities maintained and reached by the passenger engine yesterday, it is necessary to state that she has not been

constructed for high speeds. The Tiverton branch, for which she has been built, has very heavy gradients: as heavy, if our memory does not deceive us, as 1 in 87, and it is with a view to the working over such gradients that the diameter of the driving-wheel has been limited to 4 feet 6 inches. A similar description of engine-carriage, but with the common horizontal boiler and a 5 feet driving-wheel, is in the course of construction for the Eastern Counties Company. We have little doubt that from 56 to 60 miles per hour will be reached by the latter engine.

The singular feature in the construction of these light engines is, that we are returning nearly to the very weight of the late George Stephenson's old *Rocket*, which carried off the prize on the memorable trial of locomotive speed upon the Liverpool and Manchester Railway, in October, 1829. The *Rocket* was, road-worthy, 4 tons 5 cwt. With her tender, 3 tons 4 cwt., including coke and water, she took two loaded carriages, weighing 9 tons 10 cwt., or a gross load of 17 tons, at a maximum velocity of 20 miles per hour. That experiment was upon a level run of 2 miles. We here see that with an engine and tender weighing together, in working order, 7 tons 9 cwt., a speed of 20 miles per hour was reached with a gross load of 17 tons. The *Fairfield* engine—tender, water, and coke—weighing 5 tons, will, with a gross load of 13 tons, reach a velocity, we believe, of nearly 50 miles per hour on a level; and we have no doubt that the engine-carriage now being constructed for the Eastern Counties Company will, with its tender, coke, and water, weighing 6 or 6½ tons, take a gross load of 17 tons at 45 miles per hour. Such are the locomotive improvements over a period of 20 years. We believe the improvements in steam power, as applied to navigation have been greater, and that during the last ten years we have reduced the dead weight of steam vessels one-third, and increased the relative power of the engine six-fold.

The question involved in the construction and working of the steam-carriage engine, is its commercial utility. The view taken by Mr. Adams and Mr. Samuel is, that by the adoption of it two advantages will be secured—the one, that many of our branch lines may be worked at one-half the present cost, both with respect to the outlay for stock, and wear and tear of the road, and that a large percentage of saving of coke will also be realised; the other, that a double line of light rails may, if land-owners can be induced to assist in the construction, be laid down for £5,000 per mile, working stock included. Mr. Adams and Mr. Samuel conceive that so cheap a rate of construction would enable land-owners to bring very large agricultural districts into a high state of cultivation by affording them the means, in the first instance, of the cheap conveyance of manure; and in the next, a means of carrying their produce, at low charges, to markets from which they are now, by distance and the expense of transit, entirely excluded.

Perhaps the real objection which lies against the eight-inch cylinder engine is its incapability of dealing with a fluctuating traffic. The trade of a branch line may be light to-day and heavy to-morrow. The average number per train may, it is true, be but twenty or thirty, but occasionally sixty, or seventy, or a hundred may require accomodation. With good gradients the little engine could, of course, deal with such a load at reduced rates of speed, but she would want further passenger accommodation. It might, therefore, be necessary to provide, at least the down terminal station, with some of the ordinary carriage stock. But this objection, however, is one which supposes that Railway Directors will run upon their branch lines a new species of stock inadequate to the requirements of the ascertained traffic. We think Directors have *now* learnt wisdom, and that the Bristol and Exeter Board are perfectly satisfied that the *Fairfield* will do all the work they require of her.

There are many branch lines where the passenger traffic is far too heavy to be worked by 8-inch cylinder engines, unless the trains were very frequently run. It will, we know, be contended by Mr. Adams and Mr. Samuel that frequent trains are the needful things for branch traffic; but these gentlemen must bear in mind that branch lines with heavy traffic generally, have a considerable amount of goods trade. To work such a traffic with 8-inch cylinder carriage-engines would require a very considerable number of trains, and a large number of drivers. The economy of 8-inch cylinder carriage-engines would in this case be extremely problematical.

We at once and unhesitatingly admit that the saving in wear and tear of permanent way will be very considerable where the little engines can be brought into use. We are also ready to admit that light engines may be constructed for running light express trains over main lines, but there would be little economy in this unless the speed of the goods trains were reduced at the same time.

For such branches as the Deal, the Bedford, the Dunstable, the Aylesbury, the Cirencester, the Clevedon, the Newmarket, the Hertford, and twenty others of light traffic, the use of the passenger carriage-engines would effect a considerable saving; in fact, it would convert a positive loss into a positive gain.

On Saturday we gave a description and the workings of the passenger-engine built by Mr. Adams for the Tiverton branch of the Bristol and Exeter Railway. We now propose to give a description and the workings of a little six-wheeled passenger-engine of the ordinary character, constructed by Mr. England, of Hatcham Works, near the New-cross station, Deptford. The engine, which is called the *Little England*, has been built as a model of a class of locomotives for carrying on the traffic of branch lines, and its performances are so good, and so pregnant with useful results, in relation to the working of light and short traffic, that an extended notice of them is, we think desirable.

The important difference in the mode of working the traffic by the two little engines mentioned is, that the *Fairfield*, with its tender and passenger-carriage, are upon one frame, and that the *Little England* and its tender, both on one frame, work the ordinary stock of a Company.

The *Little England* and tender weigh together, when roadworthy, 9 tons 5 cwt. The *Little England* has a 7-inch cylinder, a 12-inch stroke, and 4 feet 6-inch driving wheels. The diameter of the leading trailing wheels is 3 feet. The distance between the extreme centres is 14 feet. The boiler has 60 tubes, 11 feet 2 inches in length, with a diameter of 1⅝ inch inside. The fire-box has an area of 27 feet, and the total heating surface is 282 feet. The tank holds 268 gallons. The *Little England*, therefore, while the diameter of its driving-wheel, and its length of stroke are those of Mr. Adam's *Fairfield*, has an inch less of cylinder, but 2 feet more of fire-box, and 47 feet more of heating surface, while her weight, including tender, coke, and water, is about 4 tons heavier. It will, however, be seen that the *Little England* is in no way inferior in her performances to the *Fairfield*, but that in fact she has taken a gross load of 22 tons up a gradient of 12 feet per mile at a greater velocity than the *Fairfield* propelled a gross load of 13 tons up a gradient of 4 feet per mile. But there is this difference between the two engines. The *Little England* is a first-rate piece of workmanship; at the highest pressure, although the engine is just out of the shop, not a breath of steam escapes, except through the blast pipe and safety-valve, and she runs what the drivers call perfectly "sweet"—that is, easy in all her parts. At 30 miles per hour she glides along almost noiselessly, and with all the steadiness, of a well-balanced, properly coupled, first-class carriage when running at one-third of the speed. A more beautiful model of a locomotive we have never seen. On the other hand, the *Fairfield* has had her boiler very badly made; the springs of her driving wheels are much too rigid, and those of her trailing-wheels far too flexible; so that throughout the down and up trips between Paddington and Swindon on Friday last a considerable loss of power was sustained from the boiler leaking into the fire-box, from the sharp blows given by the rigid spring of the driving-wheels, and the irregular motion, frequently of a very disagreeable character, caused by the weakness of the trailing-wheel springs. All these things will, we are quite sure, be avoided in the passenger-engine, now almost finished for the Eastern Counties Railway. Mr. Adams has secured steadiness by the extreme length, 28, feet, between his driving-wheels and the trailing-wheels of the carriage; Mr. England has obtained equal steadiness by placing the axles of the leading wheels of the engine and the trailing-wheels of the tender exactly one-half the distance—viz., 14 feet.

The *Little England* started from the New-cross station of the Brighton Railway, with three first-class carriages containing thirty-one persons, among whom we observed Mr. Ransome, the Deputy-Chairman of the Eastern Union and Hadley Branch Railway; Mr. C. H. Gregory, the engineer of the Bristol and Exeter Railway; Mr. Peter Bruff, the engineer of the Eastern Union Railway; M. A. Weightman, the manager of the Blackwall Railway; Mr. J. Cubitt, C.E., Mr. Statham, and several other gentlemen connected with railway engineering. The gross load was, as we have stated, about 22 tons. The weather was fine, but a very strong side wind was blowing the whole of the down and up journeys. At starting the

engine had very little pressure in the boiler, and the New Cross incline—2½ miles of 1 in 100—was not worked over in less than 10 min. 34 sec. Including the time lost by the engine thus starting at a low pressure, and including also a stoppage of 8 min. 47 sec. at the Three Bridges station, the 47½ miles—viz., from New Cross to Brighton, were performed in 1 hour 48 min. 45 sec. Deducting the stoppage at the Three Bridges station, the average speed was 28 miles per hour.

The following are the detailed workings from the 26th to the 36th mile posts in the down journey, and from the 36 to the 26th mile-posts in the up trip. The gradients over this portion of the line will be found appended to the workings:—

Gradients.	Mile posts from London.	Miles per hour.
Rise 1 in 460.	25¼	38.7
	25½	38.7
	25¾	37.5
Rise 1 in 466	26	36
	26¼	35
	26½	34.6
	26¾	33
	27	33
Rise 1 in 264	27¼	32.1
	27½	31
	27¾	30.3
	28	30
	28¼	29.8
	28½	29.5
	28¾	29.6
	29	26.6
	Stopped at the Three Bridges Station.	
Rise 1 in 264	30¼	22.2
	30½	24.2
	30¾	26.3
	31	27.1
	31¼	27.8
	31½	28
Fall 1 in 264	31¾	30.3
	32	31.6
	32¼	32.3
	32½	33.3
	32¾	34.6
	33	35.3
	33¼	36.7
	33½	36.7
	33¾	36.7
	34	36.7
	34¼	36.7
	34½	37
Fall 1 in 264	34¾	37.9
	35	37.9
	35¼	38.6
	35½	39.6
	35	41.5
	36	41.9

Gradients.	Mile posts from London.	Miles per hour.
Fall 1 in 460	25¼	48
	25½	48
	25¾	48.6
Fall 1 in 666.	26	48.6
	26¼	49.8
	26½	50.7
	26¾	50
	27	49.3
Fall 1 in 264	27¼	49.3
	27½	49.3
	27¾	49.3
	28	49.6
	28¼	49.6
	28½	49.3
	28¾	49
	29	49.3
	No stoppage at the Three Bridges Station.	
Fall 1 in 264	30	—
	30¼	43.6
	30½	41.4
	30¾	40
	31	38.3
	31¼	36.3
	31½	32.7
Rise 1 in 264	31¾	31
	32	30.3
	32	29.3
	32½	29
	32¾	31
	33	32.1
	33¼	33.6
	33½	33.6
	33¾	33.6
	34	33.6
	34¼	31.6
	34½	31.6
Rise 1 in 264	34¾	31.6
	35	31.6
	35¼	31.6
	35½	32.6
	35¾	32.6
	36	32

It is here seen that the maximum velocity of the *Little England*, down 1 in 264, was nearly 51 miles per hour; and that the maximum velocity up the same gradient was 33.6 miles per hour.

The valve was screwed down to 105 lb. at which the engine keeps steam very well. The consumption of coke for the down and up journeys averaged 8 lb. per mile. The consumption per mile for the up journey was about 6½ lb. per mile.

In the notice in Saturday's *Herald* of the performances of the old *Rocket* of the late George Stephenson, the maximum velocity attained during the celebrated trial of speed upon a level portion of the Liverpool and Manchester line (October 1829,) was made by mistake, to be 20, instead of 29 miles an hour. The precise maximum speed was 29 1-9, and the pressure in the boiler is stated to have been 50 lbs. only.

We believe that the *Little England* will *maintain* on a level an average speed of 45 miles per hour with a gross load of 20 tons, or 16 miles per hour more than the *maximum velocity reached* 19 years since with a gross load of 17 tons with the *Rocket*—an engine which was at that time very justly deemed a wonderful specimen of mechanical skill and ingenuity.

Such a locomotive as the *Little England* would, with wheels of 3 feet 9 inches diameter coupled, and a 9 or 10-inch cylinder, be able to work, at a speed of 10 or 12 miles an hour, the goods traffic of nearly all the smaller branch lines in the kingdom. We believe also that with its small cylinder and the perfectly safe ability of working the boiler at 140 or 150 lbs., the *Little England* would be able to work trains of five or six passenger carriages at moderate speeds, over even very heavy gradients, and that she would do so at a very low consumption of coke.

With engines of the *Little England* or *Fairfield* class, the services of half the "permanent-way men" employed upon branch lines might be dispensed with, and the rails would last at least five times the period of their present duration; and it is thought that with 12-inch cylinder engine working at high pressure—and such a pressure might be secured with an engine and tender weighing together not more than 12 tons—the passenger traffic of the majority of the railways of the country might be managed at moderate speeds and at a greatly reduced cost, both in working expenses and maintenance of way.

Analysis of Books.

Partial remedies for West India distress. By Henry Crosley. London.

When the moralizers of other days used to hold forth on "the lump of sugar stained with the blood of the negro," they little thought that the time would come, when their sympathy would be required on behalf of those, whom at that time it was the fashion to decry. If Wilberforce himself could rise from his grave and witness the results of his life's great labour—the bankruptcy of the once wealthy planter, on the one hand, and the horrors of the middle passage on the other—he would probably be the first to confess how far the effects of his scheme had fallen short of his expectations. The condition to which our sugar-producing colonies have been reduced, and the present activity of the slave trade, are facts so notorious, that it would seem impossible to put in any stronger light, what has been so prominently brought forward by the daily press. It is an unfortunate *fact,* that we cannot enjoy cheap sugar, and the credit of putting down the slave trade, at the same time. The two things are incompatible, for the present, at least.

We might enlarge on the inconsistent policy which reduces the duty on slave-grown sugar, with the one hand, and with the other vainly attempts, at an enormous cost, to check the traffic in human flesh, whilst it does but increase the misery of those whom it attempts to save. Our present object however, is rather to draw attention to the plans which have been suggested to enable our own colonists to compete with the slave-holder, by diminishing the cost of production.

Under the modest title of "Partial remedies for West India distress," Mr. Crosley, who is well-known for his inventions connected with sugar apparatus, has produced a pamphlet, which is well worthy the attention of all connected with sugar estates. Although prevented from the form of the publication from going into all the details of the apparatus mentioned, Mr. Crosley has touched upon all the chief points in the manufacture of sugar.

The first and a most important point, is the quantity of juice to be obtained from a certain quantity of canes. Mr. Crosley contends, that from driving the mills too quickly, a large per centage of the juice is left in the cane, and that megass, or crushed cane, may be more profitably employed as manure, than as fuel. The employment of filters of animal charcoal for the purpose of decolorizing the juice, and of steam for boiling it, in preference to a naked fire are severally described and commented on. A comparison is also made between the use of the vacuum pan, and Kneller's pan as improved by Mr. Crosley. The, latter as most of our readers are doubtless aware, consists of an open pan, in which the juice is boiled, furnished with a set of air pipes, a number of which, about an eighth of an inch in diameter, are placed with their orifices a few inches from the bottom of the pan. Air, under pressure, is driven through the juice, and materially assists the evaporation, whilst at the same time, its cooling influence prevents the juice from attaining a high temperature, which is a great desideratum in the manufacture.

We shall return to this subject, next month, when we shall be able to go more into the details of the apparatus used in the manufacture of sugar.

The Architect's, Surveyor's, and Builder's Almanack, for 1849. London: Colyer.

This is a useful sheet Almanack, for the office. Principal contents:—List of Official Referees and District Surveyors; Abstracts of the Building, Paving, and Chimney Acts; Sections of Buildings of different rates, according to the Act; Rates of Fees to District Surveyors, &c., &c. The boldness of the red and blue type is a good feature.

Notes of the Month.

English and American Postage.—The American Post Master and the President recommend a uniform postage of 5 cents the half ounce for letters, 1 cent the ounce for newspapers, 2 cents the half ounce for periodicals, 15 cents the half ounce for foreign letters, the utter abolition of all franking privileges, and the prepayment of everything sent by the mail. On our side we are happy to state that the differences have been arranged, and that a postage treaty has been drawn up to the effect that one shilling shall convey a letter from any part of the United Kingdom, to any part of United States, and *vice versa*, with provision for newspapers and pamphlets at low rates. The treaty has not yet been ratified, but in anticipation thereof, the one shilling on letters coming by the United States' packets has been taken off at once; and there is, no doubt, that the United States Post master will take off the extra 24 cents now imposed on letters arriving, by our packets, as soon as he hears what has been done on our side.

The Sheffield Times states that the staple trade is fast leaving Sheffield. Want of capital and unions of workmen are regarded as chief causes. Nothing but the introduction of a new trade, it is thought, can save the town. The unions are still destroying tools and machinery, as they have for years been doing, and we know of one case where a firm of more than one generation's standing was broken up in disgust from this very cause, nearly three years since. The stupid and suicidal unionists therefore appear to be steadily and certainly destroying their own trade, and Sheffield is likely to afford a striking example of the malign influence of such *protective institutions.*

Railways and Sanitary Reform.—In connection with the prominent, and certainly the most important topic of the day, as regards social comfort—we mean sanitary reform—it appears from an article in the *Companion to the British Almanac* for the ensuing year, that railways are showing themselves most useful. It seems that at Newcastle-on-Tyne the town's refuse has been for some years carted out on a spot in or near to the common moor, whence it was taken away in other carts, belonging to the farmers of Morpeth and other places, who paid 4s. 6d. per cart-load for it. The York and Berwick Railway has become the medium of a much-improved arrangement. The Corporation now takes the collection of these matters upon itself; the refuse is conveyed in carts to the railway, along which it is transported, in vehicles and at hours likely to be as little inconvenient as possible; and it is now delivered in the agricultural districts at 2s. 6d. per ton. The farmers of Northumberland now use the whole of the refuse of Newcastle, and the demand is far beyond the supply.

Fortifications and Defences of the Home Ports.—The following are extracts from reports of the commissioners appointed to inspect the fortifications and defences of the home ports, and to recommend improvements or additions to the existing works for the protection of the said ports:—

"Sheerness.—The floating battery should be a line-of-battle-ship, without masts, having her bow and stern strengthened and altered in form, to enable her to fire the greatest possible number of guns from those points; she should be armed with the heaviest ordnance she will bear, and be supported by a tower on the Isle of Grain, having a battery of six heavy guns in front of it. The guard-ship of the ordinary should also be equipped with eight-inch guns on the lower deck, and with her proper armaments on the other decks, and she should be permanently fixed at the moorings the Nymph frigate is now riding by, as the eddy tide at these moorings will always admit of ships being sprung with their broadsides to the entrance of the harbour. Six strong tugs of very light draft of water, but with considerable steam-power, and capable of carrying two or more heavy guns, should be permanently attached to Sheerness; they should be ready to change the position of the floating batteries, and would be generally useful for the defence of the harbour. With the floating force, the proposed batteries at Queenborough might be dispensed.

British Museum.—A specimen of mosaic pavement has been placed in the national collection at the British Museum, in the passage leading to the gallery of Xanthian Antiquities. It is about 8 feet square, and was found in the ruins of Carthage, on the spot assigned as the site of the Temple of Neptune, and was purchased by the trustees of the Museum.

Submarine Communication between England and Ireland.—The more speedy transmission of intelligence across the Irish Channel, and improved means of communication between the sister islands, will be secured by the determination of the Government to take advantage of the facilities afforded by the submarine electric telegraph. The Lords Commissioners of the Admiralty have given permission to Charles Blunt, Esq., civil engineer, to effect a communication, by laying down his submarine electric telegraph between Holyhead and Dublin. The telegraph will be connected with the lines of rails radiating with the Irish Metropolis and with the Chester and Holyhead Railway; and we understand that convenient positions at both the termini have been chosen and marked out where the wires will terminate. The Admiralty are desirous of furnishing Mr. Blunt with the necessary aid, and for this purpose have authorized Captain Frazer, R.N., the commanding officer of her Majesty's naval establishment at Holyhead, not only to permit the former gentleman immediately to commence his operations, but also to afford every assistance which he may require in the performance of his undertaking. This desirable enterprise will form another link in the great chain of communication between the two countries. By its means space will be almost annihilated, and in a few minutes the most important political intelligence, or the minutest detail of business, will be conveyed between the capitals of England and Ireland. The towns of Liverpool and Manchester would also be benefitted, as the telegraphic communications would be at least twelve hours in advance of the ordinary mails.—*Morning Post.*

Steam Communication with India.—The following letter has been sent from the Colonial Under-Secretary to Sir Thomas B. Birch, M.P., on the subject of steam communication with Australia:—"Downing-street, Nov. 30.—Sir, I deferred answering your communication of the 18th of August last, because the arrangements were still in progress for the establishment of a system of steam communication with Australia. I am now directed by Earl Grey to acquaint you that, from a letter which has very recently been received from the Board of Treasury, it appears that there is every reason to believe an engagement will soon be concluded with the India and Australian Steam-packet Company for the conveyance of the mails between Singapore and Sydney, for a period of not less than seven years. I have the honour to be Sir, your most obedient humble servant, B. Hawes.—Sir Thomas Birch, M.P."

Steamers between Montreal and Liverpool.—The Montreal correspondent of the *Quebec Mercury* says, that the first attempt at steam navigation between that port and Liverpool will be made next spring. The vessel will be a propeller of 800 tons burthen, and 300 horse-power.

Governement and Railway Steamers.—A trial of speed has lately taken place between the steam-packets run by the Government for the conveyance of the mails between Holyhead and Kingstown, and those employed for the passenger transit of the railway company. From an official return of the performances of the respective vessels, in their passage between Holyhead and Kingstown, for three months ending October last, it appears that the Government steamers have been beaten by the railway steamers, on an average of 22 minutes and 33 seconds in each trip. The average run of the *Caradoc*, Government steamer, from Holyhead to Kingstown, has been 4h. 29sec., and of the *St. Columba*, Government steamer, 4h. 32sec. The average run of the railway company's steamers has been, of the *Anglia*, 3h. 56m., and of the *Scotia*, 3h. 58m.

METROPOLITAN COMMISSIONERS OF SEWERS.

The Drainage of Peckham.—Mr. Phillips, the surveyor, presented a report on the drainage of 87 houses at Peckham, which had been completed efficiently, it was stated, by tubular drains carried along the backs of the houses. The report contained the following passages:—

"The houses had been built and inhabited for a number of years, but were in a most filthy condition from the want of drains: as the basement-floors, areas, back-yards, and gardens, were overflowing with soil-drainage, by reason of the adjacent ground being saturated with it from the numerous cesspools, which were quite full and had therefore become useless. During the progress of the work, two, and in some cases three cesspools were found in and about each house, varying from 4 to 8 feet in diameter, 10 feet in depth, and containing, on an average, 12 cubic yards of soil. Two of them

measured 20 feet in length, 16 feet in width, and 10 feet in depth, and contained together 236 cubic yards of soil. One hundred and eighty-one cesspools were found altogether; the evaporating surface of which was equal to 10,000 feet, and the quantity of soil contained within them amounted to 2,384 cubic yards or single cart loads. The quantity of soil, instead of being bucketed out and carted away, in the usual manner, which would have cost at least one thousand pounds, had been washed away, without smell or annoyance, through the main lines of the sewers; a very large quantity of water having been soon afterwards discharged from the Surrey canal close by. The whole of the cesspools, excepting one of the large ones, have been filled up with rubbish; and that one, which is situate at the head of the main drain, has been paved, well cemented inside, and made into a water tank for the purpose of periodically letting off, with a rush, a large body of water through the drains, which, by so doing, can be thoroughly scoured out.

The eighty-seven houses are drained by main drains or sewers of glazed stone-ware pipes, carried, as before observed, along the back of the houses; the outlet being twelve inches in diameter. Four-inch branch drains, of the same material, lead into the main drains or sewers, from all the water-closet pans, area, yard, and kitchen sinks, and rain-water pipes. The main and the branch pipes together measure nearly a mile in length, and the whole of the work, namely, the emptying and filling up of the cesspools, the materials and labour of the drains, sinks, traps, water-closet pans, and the making good of everything disturbed, has been executed at a cost of about 500*l.*, or 5*l.* 15*s.* per house.

If the same property had been drained under the recent system, large brick sewers would have been laid down in front of the houses; with 15-in. brick drains (the size required by the late Surrey and Kent Commission) laid into them from the houses; and the cost of the sewers and drains together would have amounted to 2,550*l.*, or 29*l.* 6*s.* per house; so that by the plan of draining with tubes laid along the back of the houses, a saving has been effected over the recent system of 2,050*l.*, or 23*l.* 11*s.* per house; and if, instead of large brick sewers and drains, fifteen-inch pipe sewers had been put down in front of the houses, with separate four-inch pipe drains laid into them from each house, the expense in this case would have been 1150*l*, or 13*l.* 6*s.* 8*d.* per house, being an excess of 650*l.*, or 7*l.* 11*s.* 8*d.* per house, over the plan of back drainage as executed."

The report was adopted.

Reports were also presented from Mr. Lovick and from Mr. J. Lysander Hale, assistant-surveyors, on the cleansing of streets, courts, and alleys by means of the hose and jet, from which it appeared that several of the most offensive courts and alleys in the neighbourhood of St. Giles's had been cleansed and rendered wholesome by these means. A calculation is given as to the time employed, and expense of this operation. To cleanse a court containing 150 square yards occupied 4½ minutes, and the cost of the work was as follows, for an area of 1,521 yards:—922½ gallons of water, 2¼d.; four men at 5d. per hour each man, 1s. 0¾d.; wear, &c. of apparatus, ½d.—total, 1s. 3½d. or about 1d. per 100 yards. A calculation is also given of the expense for cleansing the parish of St. Ann, Soho, which showed that, taking the paved carriage ways and foot pavements to comprise an area of 64,000 square yards, it might be found sufficient to cleanse 42,000 yards twice a week, and the remaining poorer part of the parish three times a week. By this arrangement there would be cleansed 150,000 yards per week, which, at 1d. per 100 yards, would cost 6*l.* 5*s.* per week, or 325*l.* per annum. The parish contains 1,460 houses, and between 16,000 and 17,000 inhabitants; and the cost of cleansing, divided equally among them, would be to each house 1d. per week, or to each inhabitant 4½d. per annum, and this would include the cleaning of the foot pavements, which are never touched by the scavengers.

In reference to the expediency of washing the street soil into the sewers, an opinion is given, that if they are properly constructed, all refuse might be washed into them with great advantages; but by arrangements of proper flushing apparatus in the sewers, the water might be so controlled as to ensure the desired end of removing the deposit, even in sewers very defective.

Construction

Metropolitan Street Improvements.—If what we hear be correct, a good deal of work is being cut out for the building trades in various quarters of the metropolis. The pulling down of a number of houses at Seven Dials indicates, it appears, the cutting forthwith of the new street determined on between the junction of Tottenham-court-road with Oxford-street and Crown-street, on the one hand, and Trafalgar-square at Hemming's-row, near St. Martin's Church, or foot of St. Martin's-lane, on the other. A new street is also about to be formed from the junction of St. Martin's-lane with Long-acre, through Rose-street and New-street into Covent Garden and the Strand. The Duke of Bedford contributes 2,000*l* towards the cost of this improvement.——New streets are to be opened from Little to Great Tower-hill, and from Tower-hill to Fenchurch-street. Bell-alley, Lombard-street, is to be pulled down and widened. The widening of Cannon-street by setting the houses on the east side 20 feet back, is to be commenced immediately, by pulling down the houses between King William-street and Dowgate-hill. The new thoroughfares from Walbrook to Southwark-bridge, and from the south side of Hungerford-bridge, through Belvidere-road across Manners-street to the York-road station of the South-Western Railway, are to be commenced: and a new street and road are also to be opened from the north side of the East India Dock-road, at Limehouses, in a north-west direction to York-place, in the Mile-end-road, by which the approaehes to the Victoria-park will be opened from Limehouse, Bethnal-green, and Cambridgeheath turnpike. Finally, the last remaining portion of St. Giles's Rookery—Church-lane—is to be demolished forthwith; and a new street opened from opposite St. Giles's Church to New Oxford-street. In the midst of all these thorough-going projects, the new street from Westminster Abbey to Pimlico makes but slow progress.

Restoration of Hereford Cathedral.—The *Hereford Journal* says that the following important resolution has recently been determined upon by the dean and chapter of that cathedral, from which beneficial results may be confidently expected to follow, not only to the decoration of the cathedral by the art of glass painting, but its preservation from the disturbance and injury of its walls and floors. The resolution alluded to is as follows:—"That in future all burials in the cathedral church shall be charged with the payment to the fabric funds of one hundred guineas; in the lady arbour and cloisters, of seventy guineas; in the churchyard, of fifty guineas. That none but flat stones shall be laid in the lady arbour, cloisters, or churchyard,—for each of which twenty-five guineas shall be paid. That no monuments shall be admitted into the cathedral but such as are strictly of the same character as those coeval with the fabric, the charge for which shall be one hundred guineas, the design to be first submitted to the dean and chapter. Should such monuments be of special character, the dean and chapter will consider what amount might be remitted; that they will allow, instead of monuments, the erection of painted glass memorial-windows, provided the design and artist be approved of in writing by the dean and chapter, upon a small payment as acknowledgement for the permission."

Abridging a Story.—Messrs. Bull, silk-throwsters, having bought a large silk factory at Congleton, found it necessary, from the instability of the upper portion of the brick-work, to reduce it from a four-story to a three-story building. To pull the roof to pieces, reduce the walls, and then reconstruct the roof would have been very expensive. Thomas Shepley, an ingenious mechanic, who had long worked for Messrs. Bull, offered to lower the roof without taking it to pieces. After preliminary preparations for conveying the bricks to the ground, he lifted with long levers, alternately, the beams which supported the roof, and supported them with small blocks of wood, whilst he lowered the walls one course of bricks at a time, so that the roof was gradually and imperceptibly lowered about eight feet to the top of the third story, without the least accident occurring, and without the breaking of a single tile, or crack in the roof.—*Bridgewater Times.*

A church with chalk columns, pillars, &c. not even seasoned, has of late been in course of erection at Prestwood, Bucks, according to the local *Chronicle*, and got on swimmingly until the frost began to operate on the moisture in that celebrated 'absorbent,' when the columns, pillars, &c. split, of course, and crumbled into pieces; and besides a damage to the amount of at least 100*l.*, it is said, on this "cheap material," will occasion the additional expense of a replacement in stone, making good the old proverb, "penny wise, pound foolish."

The restored Norman Tower at Bury St. Edmund's has been opened to the public as a thoroughfare through the area, and as the bell-tower of St. James's church.

The new Savings Bank at Cambridge has been opened. It is in the Italian style, with two fronts, and contains a hall, 18 feet square, bank room, and actuary's residence. The architect was Mr. John Smith, of Cambridge.

The New County Goal at Winchester, which is progressing towards completion, is compared by a cotemporary to a "huge barrack of water-closets," a circumstance attributable, we presume, to the fact of its being a building of comparatively confined dimensions, carried out on the separate system, and unjust if intended to reflect on the architect. It is concentradiative in form. "Gas is laid on to every cell, and the whole building is warmed and ventilated by means of nine large boilers placed round the central portion, immediately under the shaft or tower which forms so conspicuous a feature of the elevation." The chapel and exercising grounds are also of course concentradiative.

A church lately erected at Shirbeck, near Boston, Lincolnshire, at the expense of Dr. Roy, rector of the parish church, was consecrated last month.

The Rev. C. A. St. John Mildmay, as rector of Chelmsford, has wisely decided on preventing any further interments taking place in the body of the church, a resolution the more honourable to the rev. gentleman, because it is carried out at the sacrifice of his own private interests.

Railways.

THE PROPOSED AMALGAMATION OF THE GREAT COMPANIES.—From a published circular addressed to the shareholders of the London and North-Western Railway, it appears that the negociations for a junction of the three great companies, which have been pending for some time, has proved abortive. The *Morning Chronicle* gives the following *resumè* of the affair:—The point upon which the contracting parties split, was as to the representation of their respective interests in the united executive body, to be appointed under the proposed Consolidation Act. Among the resolutions considered at the conferences held between the deputations from the three boards, there was one, the eighth, which the North-Western representative insisted on specially reserving for the decision of their directors. By that article it has been proposed that, in any united board, to be created under the Act, each of the companies should, in the first instance, be equally represented in number. The North-Western delegates, as it is stated, from the first demurred, to this proposition, alleging that their great preponderence of capital and revenue justly entitled them to an amount of representation in some degree corresponding to their larger stake and interest in the co-partnership. The claim was objected to by the other deputations, but the negociations went on provisionally, and the resolutions were signed, with the saving clause—suggested, as we are told by the Great Western party, for the purpose of obviating the immediate difficulty that they should be "subject to the approval of the respective boards." On the 11th inst., the proceedings of the deputations having been reported to the North Western directory, that body came to a resolution by which the point reserved on the eighth article was decisively negatived. At the same time, in order to afford an opening for a fair compromise, the board expressed its readiness to leave the disputed question to the determination of a third party, in either of two ways—namely, by submitting it to the adjudication of the Committee of Parliament on the bill, or else to a process of arbitration. Both of these alternatives, however, have been positively declined by the other companies, and, consequently the negociations have terminated.

DEPRECIATION OF RAILWAY STOCK.—The mere depreciation of railway stock about the middle of last month, was estimated by Manchester shareholders, at "upwards of £120,000,000—that is, one-sixth of the nationol debt!"——With regard to such formidable amalgamations of capital as those of the abandoned three Westerns, and the two Easterns, lately proposed, but referring specially to the former, *Herepath* says, "it is more dangerous to the public in other respects than mere cost and inconvenience of transport. The united capital of the three companies is admitted to be £52,000,000 excluding the shelved branches and extensions; and the length of lines which they possess and have an interest in, excluding again those put on the shelf, are 2,080 miles; and the united territory which they propose to monopolise, taking half of England, the whole of Wales, only one third of Scotland, and none of Ireland, is nearly 43300 square miles. With such power as this, backed by the patronage of £52,000,000 of money, turning in a revenue exceeding £5,000,000 per annum, which it probably will, what ministry could stand against it? *It would be like putting the ballast of the state vessel all on one side.*"

OPENING OF THE TORQUAY EXTENSION OF THE SOUTH DEVON.—The opening of this line was attended with great *eclat* and public rejoicing, The weather was most favourable, and thousands of the inhabitants were abroad to be spectators of the first train careering through the valleys and ravines of that picturesque district. The opening of this line places Torquay within one hour's ride of Exeter, and $5\frac{1}{2}$ of London.

THE WORKS ON THE LONDON AND NORTH-WESTERN AT LIVERPOOL.—These works, which are of a similar description to those at Euston Square, are now nearly completed. The whole area of the station has been considerably enlarged, and the mouth of the tunnel terminating at Edgehill, widened. The new offices will be in use next week. The whole façade, fronting St. George's Hall, the exterior of which is also nearly finished, is to remain with some few alterations, such as carriage-ways and promenades. The driftway of the immense tunnel, called the Victoria Tunnel, running right under Liverpool, is nearly "through." It is two and a-half miles long, and is intended to connect the goods depôt at Edgehill with the North Docks at the Mersey, so as to take all the foreign cargoes at the water's edge on to the railway at a great reduction in cost of carriage. It is expected to be ready for traffic by this time next year.

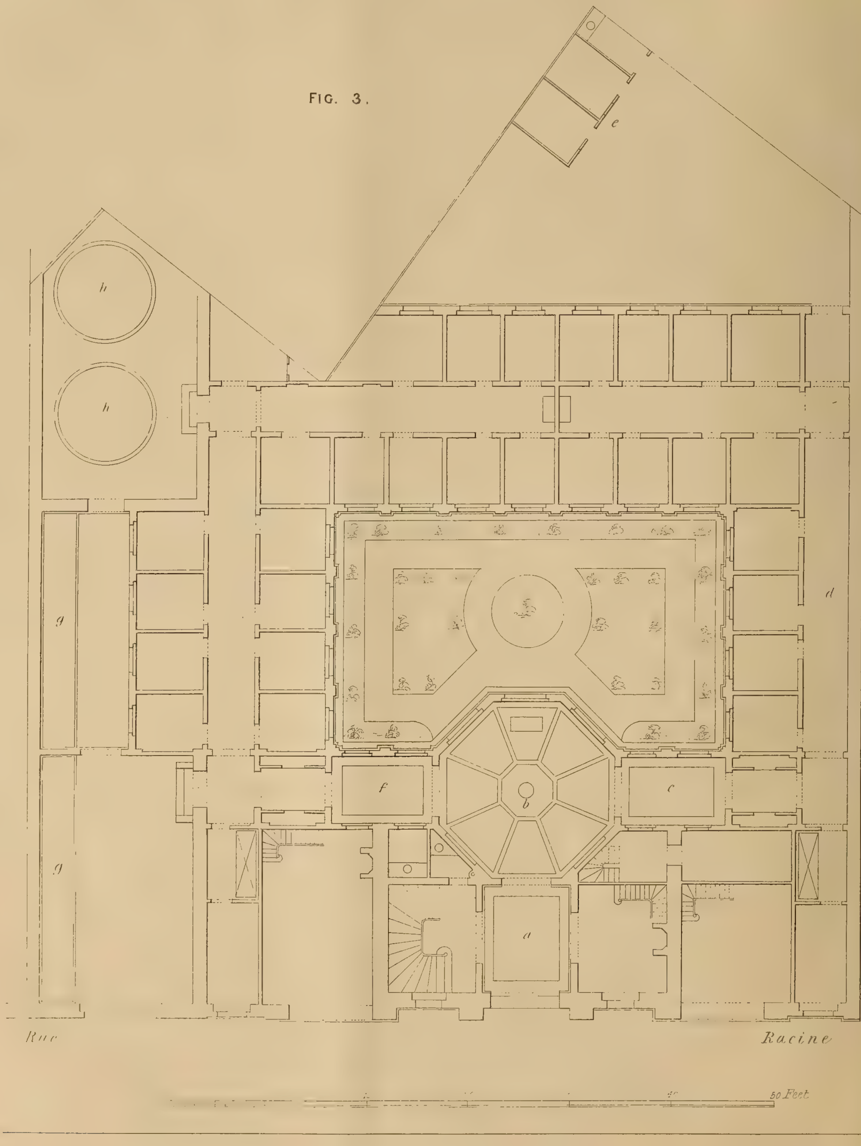
THE EUSTON STATION.—The Euston station, which has been recently completed by Messrs. Braure and Gwyther, of Birmingham, at a cost of about £150,000, is situated between Seymour-street and Whittlebury-st., and comprises an area of about 2,100 feet in length by 500 feet in breadth. On either side is a platform: the one the east side, or the arrival platform, is 1,100 feet in length, and about 40 feet in width; and the departure platform is about 800 feet in length. In this space on the various lines there are about 700 feet by 350 feet of glass roofing. There are also 16,000 feet of drains and sewerage, which have been constructed under the direction of Mr. M. A. Watkins. On the west side, adjoining Codrington-street, a number of coach factories have been erected, the area occupied by these being 300 by 400 feet. A smithy, with every convenience for the manufacturing of vehicles, is attached.

We confess we have a spice enough of uncharitableness in us to rejoice at the continued failure of the return-ticket suspension on the different lines of railway. Taking the three last weeks *before* the eventful 1st of November, the gross passenger receipts on the Great Western were £45,572 25s. 2d. for the three weeks. The passenger receipts for the three weeks *after* the 1st November were £37,282 6s.; showing a falling-off in the passenger traffic alone in these three weeks of £8,290 9s. 2d.! and this, too with $15\frac{1}{2}$ miles of additional line brought into productive operation. The whole of this diminution is on the passenger traffic alone, the goods traffic continuing nearly stationary. Again, the Midland Company's traffic for the week *before* the 1st of November was £21,446; for the week *after* November 1st, it was £20,122; showing a falling-off of £624. For the three weeks *before* November 1st, the traffic was £67,692; for the three *after* November 1st, it was £60,313; showing a falling-off, on the the three weeks, of £7,379! Thus it is clear that the railways will get less money out of the increased cost of travelling; and "the public," as the *Gloucester Journal* remarks, "may now, we think, confidently reckon on a return to the system which worked well—not only for the public, but for the companies themselves."

Notwithstanding the use of powder magazines with trains, and the prohibition of other modes of conveying gunpowder and other combustibles, so much carelessness in the disposal of dangerous materials such as these, and that by the railway officials themselves, has been occasionally evinced, that complaints and warnings have repeatedly been given by prudent persons to more than one of the principal companies. Prohibiting other modes of transit, and taking special charge themselves of such materials, it certainly is incumbent on them to carry out the most stringent regulations for their safe disposal at every stage of their transit. Nevertheless, an accident has just occurred on the Eastern Counties line which perilled the lives of numerous parties whose escape was all but miraculous. Nearly two cwt. of powder in two separate barrels, on being taken out of a train magazine at Witham, in place of being warily and at once disposed of in a place of safety, were carelessly put down in the very way of a mail train, which ran right over them, the engine crushing them to pieces, while the sparks from the grating in a moment exploded the whole, throwing the engine upwards and sidelong off the rails, tearing up the permanent way, smashing several of the carriages, and arresting the train with a sudden shock. Had the sparks taken even a single second longer to reach the powder, the explosion, instead of taking place beneath the ponderous and resistive engine, must have slain every soul in the carriages behind it. Railway recklessness meets amazingly often with "the devil's own luck:" it is, indeed, amazing, how the merest and most critical chance so often tempers such fatalities with merciful interposition. We would not advise railway officials to trust too much or too long to such chances, however.

BATHS, RUE RACINE, PARIS.

FIG. 3.



BATHS AND WASH-HOUSES
PAUL STREET, LIVERPOOL.

FIG. 2. ONE PAIR STORY.

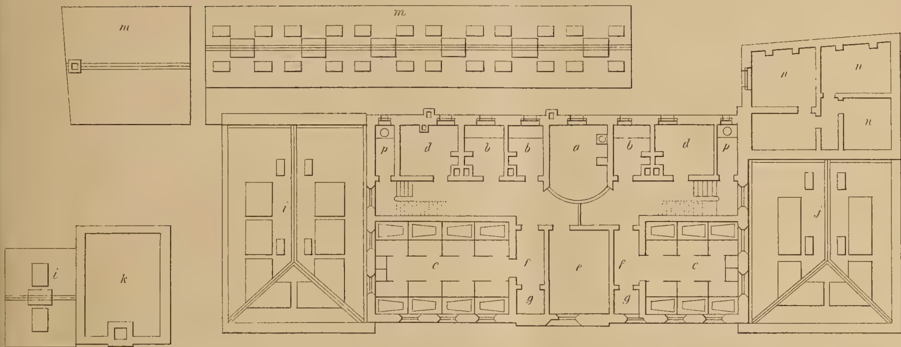
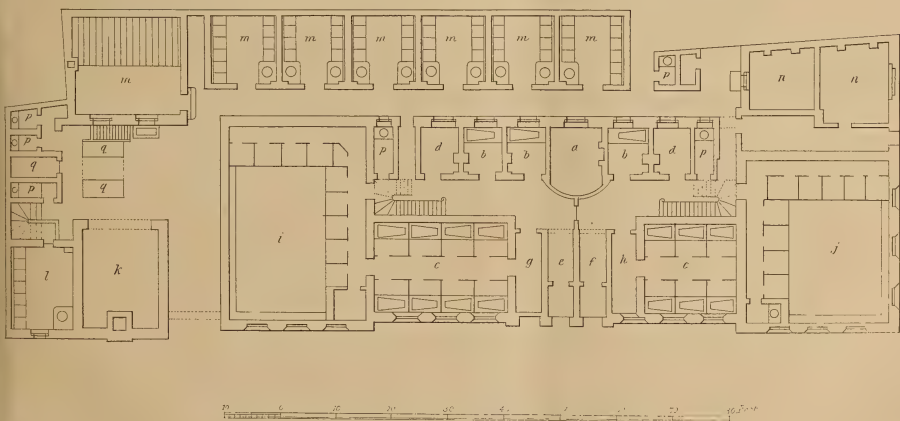
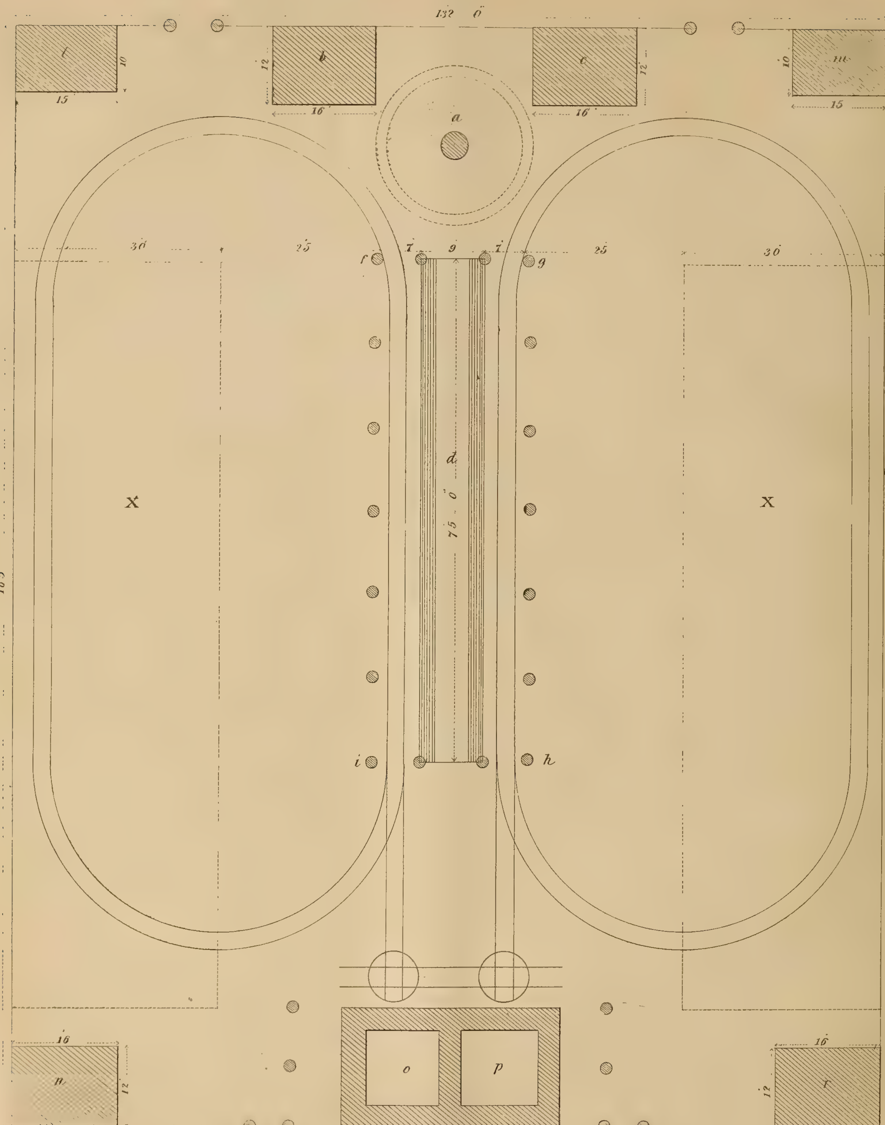


FIG. 1. THE GROUND PLAN.



GENERAL PLAN OF A TILE MANUFACTORY.



Scale 20 Feet to an Inch.

FIG. 2.

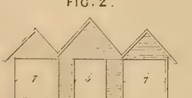


FIG. 4.

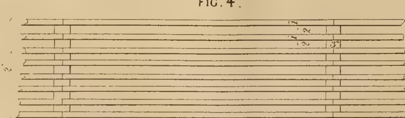
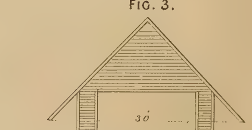


FIG. 3.



Day & Son Lithrs to the Queen.

THE ARTIZAN.

No. II.—Fourth Series.—FEBRUARY 1st, 1849.

Mechanical Engineering.

THE ECONOMY OF STEAM POWER.

It is a common saying, that people often go farthest from home for what is nearest to them—so near indeed, as to be overlooked. We saw an amusing instance of this the other day on going into a manufactory, where some smoke-consuming and fuel-saving project was in process of erection. The inventor, who was superintending the alterations, and whose men were playing dreadful havoc with the brickwork of the boiler which was standing idle, was very sanguine that at least 20 per cent. of fuel would be saved by the adoption of his scheme. A glance from the boiler-house into the engine-house showed us that whatever might be done with the furnaces of the boilers, all avenues to improvements in the *engine* were not entirely closed up.

On a long length of steam-pipe, entirely exposed, were hanging five wet jackets, drying very comfortably, and sending up a cloud of steam, which reminded us strongly of the washhouses in Glasshouse Fields. The cylinder, saved by its position alone, doubtless, was not graced with any such appendages, but was equally free from any proper clothing. Now, here was a case where an important saving of fuel might be effected *with certainty*, and at an almost nominal expense; but it seldom happens that persons who have a smattering of engineering, will condescend to such a plain, straightforward, method of proceeding. An inventor has only to propose to reverse the laws of nature and common sense, to meet with abundant support, and the more mysterious in its operation and startling in its name a project is, the better they like it.

An indicator card taken off the top of the cylinder of the engine we have mentioned, showed an extremely low amount of work, although the engine appeared to be heavily loaded, and a heavy jump was perceptible when it turned the centres. The jam-nuts of the slide cross-head were fixed by split pins, and did not appear to have been moved, and there was no convenience for attaching the indicator to the bottom of the cylinder (which ought to have been provided by the engineer who made and erected the engine), or the error would have been immediately observed. As it was, a more searching investigation showed that the plummer-blocks of the weigh-shaft had been moved, which had the effect of virtually shortening the eccentric rod, and of throwing all the steam on the under side of the piston; this fully accounted for the discrepancy between the indicator card and the actual work on the engine. It appeared upon inquiry, that the foundation had been repaired, and the weigh-shaft plummer-blocks had not been replaced in their proper position. We know, from personal experience, that things of this kind are not uncommon, even in factories where the proprietors express themselves perfectly satisfied with their machinery. We mention this to show how easily such people may be led by the nose by a skilful practitioner, who, by making judicious improvements in the various details may obtain a grand total, which is often put to the account of some new-fangled and expensive scheme, which has the luck to be taken in hand by a practical engineer.

We have often been surprised at the tenacity with which some firms will stick to the old-fashioned low pressure steam, 4 or 5 lbs. per square inch, even when the chance of putting in new boilers occurred, and where a considerable saving of fuel might be effected, and the power of the engine increased, by raising the pressure of the steam and cutting it off rather sooner by the slide; the government dock-yards are peculiarly notorious in this respect. Some thousands of pounds per annum are wasted by the high-pressure-phobia of the authorities. It must have cost them a severe pang to allow 15 or 16 lbs. per square inch in the fast mail-boats. With respect to boilers, we have recorded our opinion pretty strongly at pages 122 and 141 of our last volume, where we think we have satisfactorily shown that the cylindrical boiler with the fire in the tube, is far preferable to the waggon shape; not that we consider the cylindrical one as perfect, by any means. If any of our friends can design a boiler, the heating surface of which shall be composed of *thin tubes*, to allow of the rapid transmission of heat—which shall have sufficient area of water-level to prevent priming—which shall require as few stays as possible—be economical in construction, and be easily cleaned out—all we can say is, that we shall be as happy to publish it, as to hear of their making a fortune by it. We recommend this as a problem to our scheming readers.

A great deal of expense is often incurred, both in first cost and in repairs, by the clumsy methods adopted for driving factory gearing. In a large factory, two parallel lines of shafting may be driven off an engine, the fly-wheel being made a spur-wheel, and driving two pinions on the lying shafts. These spur fly-wheels were first introduced, we believe, by Mr. Fairbairn, and afford a simple means of getting up the speed of an engine; the spur-wheel being large, admits of a large pinion, and the wear of the teeth, being distributed over a great number, is not likely to give trouble.

There is a good example of this kind of arrangement at Woolwich dock-yard, where the engines, a pair of thirties, drive the saw-mills and two sets of three throw pumps for draining the dock. The saw-mill shaft is under the engine-foundations, and is driven off the fly-wheels; the pumps are worked by bevil-wheels on the crank shaft of the engines, and the pump crank shaft. The pump-shafts are connected by a pair of spur-wheels, so that either engine can work either set of pumps, and by drawing the bevil-wheels entirely out of gear, and throwing the pinions of the saw-mill shaft in gear, the power of the engines is applied to the saw-mills.

It is a point worth attending to in a factory, to arrange the shafting in such a manner, that if part of the machines only are at work, the shafting driving them may be thrown off the engine also, by means of couplings. This not only eases the engine of the friction, but affords a favourable opportunity to examine and clean those bearings, tighten up the nuts, &c. It is also convenient to have light shafting turned all over with loose collars, fixed with set screws. A drum can them be slipped along, wherever it may be wanted. There is a saving in not having the collars forged on, and the shaft will be stronger the less of the outside skin is taken off.

THE ELECTRIC LIGHT.

MR. STAITE'S SPECIFICATION.

[Specification of Patent granted to William Edwards Staite, of Lombard-street, City, for improvements in the construction of galvanic batteries, in the formation of magnets, and in the application of electricity and magnetism, for the purpose of lighting and signalizing, as also a mode or modes of employing the said galvanic batteries, or some of them, for the purpose of obtaining chemical products, parts of which improvements are a communication. Patent dated July 12, 1848.]

We hasten to give our readers the earliest account in our power of this invention, which has excited more curiosity, probably, than any that has preceded it for many years. We are obviously unable to go into the minute details of such a lengthy specification, but we imagine that we can enable our readers to form a correct idea of the chief points contained in it.

The first division of the patent embraces the improvements in galvanic batteries, which are proposed to be constructed on the "perfluent" principle, so denominated in contradistinction to the "percolating" principle at present in use. On the percolating principle, the exciting liquid employed is applied to, and escapes from, each cell of the battery, independently. On this system, a large proportion of the liquid is not beneficially employed and runs to waste, and the metals, being unequally worn, do not last so long as they might otherwise do. In the perfluent battery, the liquid is supplied in one stream, which enters the first cell of the series, and passing through them all consecutively, is discharged from the last in an exhausted state. One of the batteries shown consists of a wooden trough with a false bottom, the intervening space being divided so as to form a series of chambers on each side of the trough. Vertical slate partitions are placed transversely on the bottom, as in ordinary batteries, and two holes drilled between each pair of partitions, one at each side, which connect the chambers formed by the false bottom with the spaces between the partitions. A flexible pipe is fixed at each end of the trough, one for the inlet and the other for the outlet of the liquid, which thus has to travel through all the spaces before it escapes.

This arrangement is suitable chiefly for batteries in which only one sort of exciting liquid is used; where two are used, as in Daniell's, another arrangement is employed, but on the same "perfluent" principle.

The perfluent principle may also be carried out by employing syphons to convey the liquid from one cell to another, and various methods are described for providing an equable supply of the exciting liquid, in the several cases where diluted sulphuric acid and solution of sulphate of copper are used.

The third part of the invention consists in what the inventor terms "an equilibriated hydraulic cistern and graduated meter," which is for the purpose of affording a regular supply of liquid, and an easy method of regulating and measuring its flow. The equilibriated hydraulic cistern consists of a vessel containing the liquid, with an air-tight top, and a small chamber at bottom, through which the liquid escapes as it is drawn off by a syphon. The longer leg of this syphon hangs in the meter, which is a cylindrical vessel, graduated in its height, and having a small orifice at the bottom. The rate of flow through the syphon and the meter by this orifice, may be determined by observing at what height the liquid stands in the meter, the syphon being raised or lowered, according to the quantity of liquid which it is desired to draw off.

Fourth, The use, in batteries having either copper, or mercury, for the negative element, of a liquid amalgam compound of zinc and of mercury, enclosed in a bag or case of lawn, horse-hair cloth, or other reticulated fabric, provided it be not a metallic fabric, and exposed to the action of the acid.

Fifth, The use in galvanic batteries of plates of a similar amalgam, composed of five parts of zinc to one of mercury.

Sixth, The employment in batteries of lead as the positive element, combined with any known negative element; though, Mr. Staite remarks, the best negative element would be a surface of platinum.

The seventh part of the invention consists of an improved galvanometer, which is to be attached to the battery, in order to indicate to the eye the exact amount of galvanic electricity which is being circulated at any particular moment. The galvanometers usually employed for measuring the quantity of an electric current, are incapable of being used while the battery is applied to perform its work, nor can they indicate the amount of action or electricity circulating while such work is being performed, and these, with several other defects—such as their indications or degrees varying in a different ratio to that of the quantity of electricity passing—cause such galvanometers to be useless for most practical purposes. Mr. Staite's galvanometer is such that it can be made a permanent adjunct to, or part of the battery, so as to be always indicating what amount of electricity is circulating, when any sort of duty is being performed by it, and the weights of materials combining or used per minute at any particular time. The importance of these improvements may be measured by this consideration, that the cost of working a battery depends but little on the size of its elements, and varies precisely according to the rate at which its electricity is used by any particular work which it is set to perform. This improved galvanometer consists of a thick piece of insulated copper wire, wound round a wooden or brass cylindrical centre, fitted with ends. One end of this coil is in metallic connection with the positive or negative pole of the battery, and the other extremity is placed in connection with the part of the lamp, (or other piece of mechanism for actuating which the battery is used,) which would receive the conductor from the said pole of the battery. In fact, this galvanometer forms part of one of the conductors of the battery, which conveys its electricity to perform its assigned work. In the hollow or cylindrical centre of the coil there is placed a rod of soft iron, which moves loosely up and down in it, and is prolonged by a short brass stem or index. A graduated scale is fixed to, and rises from, the upper end of the coil, so as to show the height at which the electric influence causes the index to stand. The graduations are represented in the figure as marked on a glass tube, within which the index and rod slide. These graduations are so made as to indicate the number of grains of pure zinc consumed per minute, in each cell of the galvanic series, the current produced by which causes the index to stand at each such division of the scale. Any galvanometer of this kind can be graduated from a standard one, by connecting both in the same circuit, and by working a Wheatstone's rheostat, also included in the circuit, until the standard galvanometer indicates the particular units or degrees, when a similar mark should be made at the point to which the index is directed on the scale of the other galvanometer. The standard can be graduated by ascertaining experimentally the weight of zinc consumed per minute; but a less tedious process is to graduate it from a *Petrie's Galvanometer*, which indicates all the required units of electricity and their fractions by means of weights; the accuracy of that instrument being first tested by one such direct experiment on the zinc consumed. The improved galvanometer may be made of a shorter and thicker wire, making fewer coils, if the iron rod is partially counterpoised by a spring or weight, or hydrostatically with mercury.

The eighth part of the invention consists in the formation of magnets in the manner following. The best Swedish charcoal iron is to be "converted," not in the ordinary manner, but only by a slight carbonization, or what is technically termed, carbonizing it "just steel through." The blistered product is then melted and cast, and the ingot resulting from the process is rolled out into thick sheet metal.

The ninth part of the invention consists in the following improved mode of hardening magnets, previous to magnetizing them. Instead of heating them, as usual, in an ordinary furnace or sand-bath, they are heated in a bath of melted metal, raised to a red heat (using by preference lead,) first polishing the magnets, in order to prevent the lead or its oxide from adhering to their surfaces, the heat of the lead being only just sufficient to harden the magnets; on taking them out of the bath, they are afterwards plunged into water.

The tenth part of this invention, has reference to improvements in effecting the motion of the electrodes in electric lamps, employed for the purpose of producing a continuous light for illuminating purposes, or for the production of a regular intermittent light applicable to light-houses. The improvements in this particular consist of an apparatus for elevating the electrode as it is consumed or transferred to the opposing electrode by the passage of the electricity, and is an improvement on a former patent, dated July 3rd, 1847. In this case, the supporting stem of the lower electrode terminates at the lower end in a rack, which gears into a pinion, on the axis of which is placed an escapement wheel, worked by means of a double pall, one of which drives the wheel in one direction, while the other propels it in the opposite direction. This double pall is pivoted in the centre (the opposite ends being the parts that fall into the teeth) to a lever, one end of which has a slow oscillatory motion communicated to it from a crank, actuated by

a train of wheel-work, the motion of which is maintained by springs, or some suitable maintaining power, and the direction of motion given to the wheel will depend upon the pall in gear; this is determined by what he terms a regulator-coil; this regulator-coil is placed in the circuit producing the light.

A rod of soft iron is placed in a vertical position in the coil, the upper part of which terminates in a wooden top attached to a long lever, which is elevated or depressed by the vertical rod, according to the intensity of the current of electricity; the long lever has, near its fulcrum, a small stirrup, embracing one of the palls, so that when it is elevated, it withdraws that pall from the wheel, and throws the other into gear; this will take effect when the lower electrode has been elevated too far, or brought into too close contact with the opposing electrode, and will, consequently, reverse the direction of the motion of the wheels, and lower the electrode; and, again, when it sinks too low, the palls will be reversed, and thereby raising the electrode to a position more compatible with the production of light. When the electrodes are in a position the best suited for the production of light, a small catch on the regulator-rod lever comes in contact with the crank movement, and prevents the further action thereof; but so soon as this lever is elevated or depressed by the regulator-coil, so will an upward or downward motion be imparted to the electrode. Suitable counterbalances are attached to the several parts, to ensure their proper action. By this means, a continuous and uniform light is obtained, applicable for general purposes of illumination. The upper electrode is secured in a tripod, one of the legs of which forms the conducting link, and is immediately connected with the regulator-coil before mentioned, and forming the eduction for the electric current, the induction being effected through the rack to the lower electrode.

Where it necessary to produce an intermittent light for light-houses, and other purposes, the apparatus is arranged so as to withdraw one of the electrodes for such a time as it is required to extinguish the light, which is renewed on bringing the electrodes into their proper position.

Another improvement in the lamp consists in substituting for the upper electrode, previously employed, a disc, or circular electrode fixed on an axis, which disc has a slow motion imparted to it, in any given direction, by the moving power employed in the lamp. Impinging on the periphery of this disc, there is a metal scraper, which keeps the edge of the disc clean, and free from the particles of carbon which are projected upon it by the other electrode, and which ordinarily collect in the form of a button on the point of the electrode.

The twelfth part of the invention consists in improving the intensity of the electric current, whatever may be the nature of the lamp, or apparatus, used for producing the light; this is effected by including in the electric circuit a long coil of insulated copper ribbon, wound in an iron case, whereby it will be easy, at the same time, to reduce the number of cells employed.

The thirteenth part of the invention consists in inclosing the solid electrodes, employed in electric lamps, in supporting tubes.

The fourteenth part of the invention consists in improved modes of preparing the materials for electrodes.

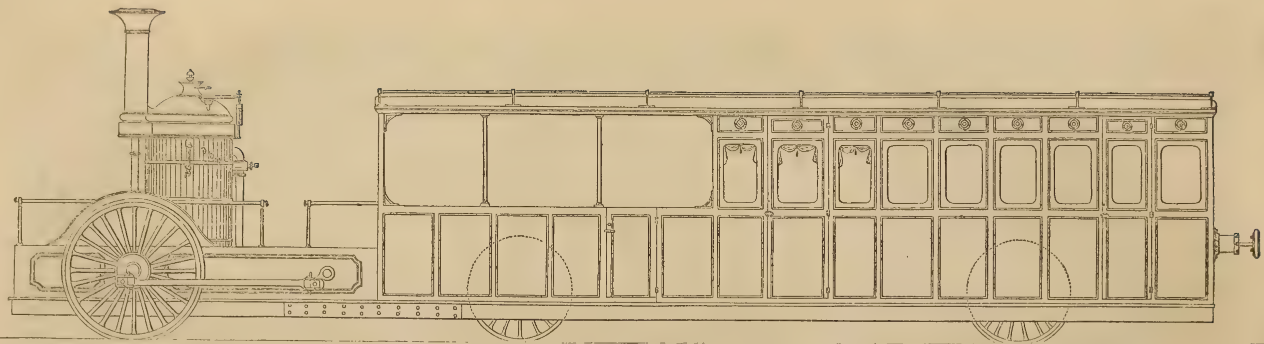
Lastly, the invention consists in the employment of galvanic batteries for the purpose of obtaining various chemical products, and this either in conjunction with the employment of them for lighting and motive purposes, or as substitutes for the ordinary processes of chemical manufacture. The batteries should be of one or other of the perfluent sorts, hereinbefore described, on account of the facilities which they afford for drawing off the products of the galvanic action, which products may consist either of matters in a marketable state, or which require some additional treatment to make them of commercial value. The elements proper to be employed will vary in each case with the chemical product or products desired to be obtained, or to state the matter conversely, the perfluent products will vary with the elements employed. For example, where zinc is used as the positive metal, with sulphuric acid, sulphate of zinc is formed; but sulphate of zinc in large quantities would not be of much commercial value. When, therefore, I use zinc as aforesaid, I collect the sulphate of zinc and treat it a follows:—I add, in a separate vessel, to the solution of sulphate of zinc a solution of sesquicarbonate of ammonia, which precipitates the oxide of the zinc metal, and releases the acid, which may be used again. This oxide of zinc is a valuable substitute for carbonate of lead as a pigment, and may be used extensively for painting purposes. Again, suppose any of the salts of lead are required to be produced, such as nitrate of lead, white lead, or sulphate of lead, or any other chemical substance to the production of which these salts may be auxiliary, the battery should be constructed of lead, or other metal plates, platinized, and excited to action by dilute nitric acid. The acid acting on the oxide of lead, formed by the electrolytic process, or decomposition of water, dissolves it, and forms with it a solution of the nitrate of lead; and this solution is afterwards treated in a separate vessel, or vessels, with the carbonate or bicarbonate of potash, when a double decomposition takes place; and, the carbonate of lead being precipitated, the matter of commerce remains in solution, and is obtained by evaporation. Supposing, further, the platinized plates of lead, or other metal are used with muriatic acid, dilute or not, then the acid is decomposed, and a solution of chloride of lead is the resulting product. If, for the platinized plates, we substitute iron or zinc plates, the chloride of iron or of zinc is respectively obtained. Should a battery of copper and of iron plates, charged with a solution of sulphate of copper, be employed, the iron is oxidized, the sulphuric acid unites with the oxide by superior affinity, and forms with it sulphate of iron (the green copperas of commerce) which remains in solution, and may be obtained by evaporation as before. The hydrogen which is released goes to the other plate—that is, to the copper plate; and, meeting there the disengaged oxide of copper, reduces it to the metallic state, and, in fact, plates the copper with it. This form of battery is directly applicable to the production of metallic copper from the ores of the sulphuret, decomposed by water, or from the water drawn from certain copper mines, which contains sulphate of copper in solution. The sulphate of iron obtained forms also a very fine ochre."

PORTER'S PATENT CORRUGATED IRON BEAMS.

We gave a detailed description of this invention in our last volume page 238, and have since had the pleasure of seeing some experiments tried on a scale sufficiently large to give perfect confidence in the results:—On the 9th. ult. and following days, the following experiments were tried upon two beams made on this plan, of the extreme length of 22-ft. The span between supports was 20-ft. 6-in.; depth of beam, 18-in.; weight of beam, $8\frac{1}{2}$ cwts.; the top and bottom frames were of 4 in. × 4 in. T-iron, and the base $\frac{1}{2}$ in. thick; the plates of corrugated iron forming the beam being of No. 16 gauge, and the bands $1\frac{1}{2}$ in. × $\frac{1}{2}$ in. thick. The two beams were placed 9 ft. apart, and across these were laid two large oak blocks, weighing 1 ton 3 cwt., and supporting the further load. These blocks, or bearers (the one 19 in. and the other 24 in. wide), were 4 ft. 3 in. apart from centre to centre, and equidistant from their centres to the centre of the beam, $25\frac{1}{2}$ in.; upon these were laid cast-iron blocks, weighing 6 tons 17 cwts. This weight was put on on Saturday and remained till Tuesday, without causing any deflection. On Tuesday, in the course of an hour-and-a-half, an additional load was applied of 121 bundles plate-iron, weighing 7 tons 3 cwts. 0 qr. 16 lbs., producing a deflection of $\frac{9}{16}$ in. This load was allowed to remain from 1 p.m. on Tuesday until 10 a.m. on Wednesday, in course of which time the deflection had increased $\frac{1}{}$ in. Fifty-one bundles of plate-iron, weighing 3 tons 9 cwts. 1 qr. 2 lbs., were now added, which caused a total deflection of 1 in. bare; rested a quarter-of-an-hour, when 32 bundles of plate-iron, weighing 1 ton 18 cwts, 0 qr. 12 lbs. were added, which increased the deflection to $1\frac{3}{8}$ in. and $1\frac{3}{16}$ in. respectively; the difference being evidently occasioned by the settling down of the piers, giving a greater load to one beam. A further load, weighing 2 tons 8 cwt. 3 qrs., brought the deflection to $1\frac{5}{8}$ in. and $1\frac{3}{4}$ in. This loading was proceeded with gradually during 3 hours, when the load was left for an hour. In the mean time a slight noise called attention to a partial dividing of the bottom flange of T-iron, in the beam which hitherto appeared the least strained: upon examination, it was found to have originated in a flaw near a "shut" in the T-iron, distant 6 ft. 3 in. from the point of support,—this caused a further deflection of $\frac{1}{16}$ in., but the fracture did not appear to increase during half-an-hour. The deflection of the beams increased to 2 in. and $1\frac{3}{4}$ in., with an additional load of 2 tons 6 cwts. 2 qrs. 22 lbs. applied gradually during three-quarters of an hour. After a further lapse of 10 minutes, a further load of 7 cwts. caused a rapid deflection in the already-weakened beam, the corrugated iron giving way at the same time to the strain of the rivets longitudinally. The beams were now blocked up to prevent any accident from the sudden falling of the load. The corrugated iron of the other beam was also found to have yielded in several places to the longitudinal strain of the rivets, principally in the lower part of the beam.

The breaking weight is, therefore, considered to be about 25 tons, exclusive of the weight of the beams.

The inventor considers that his beams will not weigh more than one half, or 5-8ths, of the weight of cast-iron beams to carry the same load, and that they may be made for £21 per ton.



This Carriage is constructed to carry 62 passengers—10 first class, 24 second, and 28 third, weighing 4 tons, on six wheels, of which the two driving-wheels are 4 ft. 6 in. diameter, and the middle and trailing wheels 3 ft. diameter. The wheels run loose on their axles, as well as the axles in the journals; this with the small distance of the frame from the rails (9 in.) gives great steadiness and freedom from oscillation, and also facility in going round curves. Cylinders 8 in diameter and 12 in. stroke; extreme centres of wheels 29 ft.; consumption of coke from 8lb. to 10lb. per mile; weight, with water and fuel, about 12 tons.

The usual dead weight of the ordinary locomotive tug, tender, brake vans and carriages to carry a similar load, would be between 40 tons and 50 tons, with an expenditure of coke from 30lb. upwards per mile. This Steam Carrriage can be worked by the driver and stoker without requiring a guard, as the brakes are on the engine within their control, and greater safety is obtained, inasmuch as the machine can be got very rapidly into speed, and can be retarded and stopped in a very short distance, owing to the small amount of dead weight. The centre of gravity being very low, it would be practicable in summer time to carry twenty-five or thirty extra passengers on the roof.

The Carriage above shewn is calculated chiefly for branch traffic at moderate speeds: but the same principle can be applied for express purposes at high speeds. The engine is made to uncouple from the Carriage when required for purposes of repairs. The Carriage is capable of easily passing round curves of six chains radius.

ADAMS'S PATENT RAILWAY STEAM-CARRIAGE, FOR FIRST, SECOND, AND THIRD CLASS PASSENGERS.

The accompanying sketch represents the general arrangement of Mr. Adams's Steam Carriage, a report of the trial of which, on the Great Western Railway, we gave last month, accompanied by a detailed account of the performance of the "Little England" light locomotive, by Messrs. England and Co. As the relative merits of the two systems demand attentive consideration, we shall abstain from offering any remarks until next month, when we hope to be better enabled to do so. For the present we give Messrs. Adams's remarks at full length:—

Remarks on the Economy of Railway Transit.—In all mechanical conveyance of persons or goods, whether by land or water, the axiom to be constantly borne in mind is, *How to transport the maximum load of persons or goods at the highest remunerating speed, with the minimum load of dead weight in the machinery of transport.*

For the paying load, from which profit is derived, consists of goods or passengers, and every ounce of surplus weight added to the machinery of transport is a source of constant deduction from the maximum profit.

In steam transit by water this principle has been so well understood and wrought out, that the steamboats of the present day, as compared with those of twenty years back, are of six times the power with one-third of the dead weight.

It may be urged that steam transit by water and by land are not analogous, inasmuch as in the former case there is scarcely any limit to size save depth of water. But on examination it will be found that the need of reducing dead weight is still more imperative on land than on water. On water, surplus dead weight operates only to waste steam power and lessen speed; on land, dead weight causes a greater proportional waste of steam power, and in addition it destroys the road-way.

For, whatever be the size of a steamboat, the water supports it by equal pressure over all its submerged surface; but in land transit with wheel carriages, the points of support can only be that portion of the wheel or wheels which impinges on the road or rail. With a truly circular wheel and a perfectly level rail, the contact can be only of a point, or the "flowing point" of the geometers, called a line. If the contact be greater by reason of an imperfectly formed wheel or rail, or by deflecting the rail, the result will be a waste of steam power in traction, and destruction by concussion.

The destruction to the roads will be of two kinds, and in proportion to the weights and speeds.

First, the displacement of the structure by deflection; secondly, the destruction of the rails by abrasion or disintegration under the heavy weights.

It follows, therefore, that the limit to weight and speed is to be found in the power of iron and other materials to resist flexure and abrasion, or, to carry it to its utmost limit, deep girder rails with hardened steel surfaces, and the best substructure that can be devised.

That the existing machines are far in excess, both for weight and speed, is almost universally proved by the condition of the railways and the expense of "maintenance of way."

There are two modes of restricting this difficulty—either to increase the strength of roads and rails, or to decrease the total weight or speed, or both conjointly, of the rolling stock.

There is also another mode—to diminish the *proportional* weight of the rolling stock as compared to the paying load. This latter principle has not yet been put in practice, and so far railway mechanism is in arrear of water mechanism.

One obvious distinction between railway transit and water transit is, that the former is wholly performed by steam tugs—the latter is almost wholly on the principle of a self-moving water vehicle. When the steam-tug is used on water, it is simply a contrivance to tow sailing vessels into a position to enable them to work by other means. When the steam-tug principle was adopted on railways, a new set of circumstances were involved beyond the mere surplus weight of the separate carriages.

Longitudinal concussion in starting and stopping, has finally settled down into the result of half a ton of spring buffing mechanism to each carriage, in addition to the greater strength of framework required, both to carry the load of mechanism and to meet alternate shocks. For it must be borne in mind, that the mere sudden retardation of the heavy engine, by getting off the line, or otherwise, produces concussion of the train, by one carriage expending its momentum on another, of precisely the same kind and proportionately destructive as though a heavy body had impinged on the hinder end of the train.

Therefore, the greater the total weight of the train, the greater will be the expenditure of power required to generate momentum, and the longer will be the time required to absorb that momentum. In other words, it will require time to get up speed in proportion to the dead weight, and the same amount of time to stop—in both cases at the cost of wasted power.

On railways there are scarcely any means of drawing comparisons of proportion—all machinery being so greatly in excess of the minimum. It is therefore by comparison with highways, that any estimate must be got at.

A first-class four-wheel carriage on the narrow guage carries eighteen passengers and weighs 4 tons.

A London omnibus occasionally carries twenty-eight persons, including driver and conductor, and weighs 18 cwt.

In short, the four wheels of the railway carriage exceed by one-third the total weight of the omnibus.

In the case of the omnibus, the dead weight to paying load is as 18 to 42.

In the railway carriage the dead weight to paying load is as 80 to 27.

This surplus weight is one of the evils involved by the principle of train traction by engine tugs.

It would not be a difficult mechanical problem to construct a steam carriage, weighing 4 tons, carrying eighteen passengers at the usual speed, and with sufficient accommodation, supposing it to be required.

But beyond the evil of surplus dead weight in the trains, another evil is involved—the requirement of additional traction force in the tug engine, with additional weight on the driving-wheels to procure adhesion to overcome this surplus weight and friction; and this evil is multiplied in additional destruction of rails.

It will take, say six first-class carriages to carry, in round numbers, 100 passengers. The passengers will weigh 7 tons, and the carriages 24 tons, in all 31 tons.

Looking at the tug-engine and tender that are to draw them, estimated at the not excessive weight of 30 tons, there will be no difficulty in granting that they are perfectly competent to carry the 7 tons of passengers on their own backs, without requiring carriages in addition.

And it will not be difficult to see that there is material enough to extend it in length and breadth conveniently to accommodate the passengers.

But inasmuch as there would be 24 tons less of weight, less power would be required to draw the load. The tug engine of 30 tons might therefore be reduced to a carriage engine of 28 tons, in which case it would carry a load one-fourth its own weight.

The saving in dead weight in a train of six first-class carriages would thus be equivalent to 26 tons, which, reckoned at the low rate of one halfpenny per mile per ton for haulage and maintenance of way, would be a saving of upwards of 6*l.* per train in the run between London and Birmingham.

The six first-class carriages would really carry 108 passengers,—but so would the carriage engine. The brakes and parcels vans, used chiefly as danger guards, are omitted from the comparison. If it be argued that 100 passengers per train is an excessive number, it will be still more in favour of the steam-carriage system, as the fewer the passengers, the greater is the disproportion on the tug system.

The comparisons of weight have been but roughly taken, and, judging by horse transit, there is much greater room for reduction. It is far within the mark to assume that 3 tons of dead load will ultimately carry 1 ton of paying load, as experience advances.

With these views, various steam-carriages are in process of construction, with the expected result of economy in first cost as well as working.

It may be argued that lighter trains may be constructed than have hitherto been used. This is possible. But the real question at issue is—"Given the steam power in boiler and cylinders, how to drive the wheels with it with the minimum of dead weight?" Steam transit on water appears to have settled this question.

It may also be argued that by the ordinary process of railway trains, the number of passengers per train is practically unlimited, whereas on the steam-carriage plan surplus passengers must be left behind.

The answer to this is, that the steam-carriage may make more frequent departures, which will better accommodate the public. Short trains and frequent would require less station room, fewer servants and porters.

And if more engine-men be employed, fewer guards will be required.

There are two classes of objects to which these steam-carriages may be applied :—

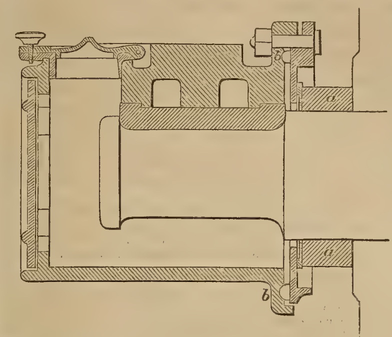
1st. To replace ordinary trains.
2ndly. As express trains.

Express trains are usually run with heavy engines, which destroy the rails with their speed by reason of their weight. But light machines may run at great speeds without damage and with a less expenditure of fuel; and in winter all the passengers' compartments may be conveniently warmed.

The advantages may be summed up as follows:—1. A diminution of dead weight as compared with profitable load.—2. A saving in fuel.—3. A diminution of expense in "maintenance of way."—4. A diminution of capital in rolling stock.—5. Increased accommodation to the public.—6. Increased safety by facility of starting and stopping to avoid danger.—7. Increased safety by lowered centre of gravity, enabling the carriage to become a self-retarding sledge in case of a wheel breaking.—8. Power of increased speed without damage to the rails or roadway.—9. Facility for the cheaper structure of railways."

NORMANVILLE'S PATENT AXLE BOX.

The annexed sketch represents an improved axle-box, the invention of Mr. Normanville, of the North-Western Railway. The objects sought to be obtained, are, the perfect exclusion of dirt and grit from the axle-box, and a very considerable saving of grease. On the old system, as we have no doubt most of our readers will have observed, the grease is allowed to escape as it is melted by the friction of the axle, and the most superficial examination of a brass which has run a few thousand miles will shew how much it has suffered from the presence of the grit, which, partly by the wind and partly by the action of the wheels, is carried into the ordinary axle-boxes.



In the sketch, AA is a section of a ring of vulcanized india-rubber, placed between the face of the nave of the wheel, and a thin ring of brass, which runs with the wheel and axle, and bears against another brass ring bolted to the axle-box. This latter ring, having a washer of vulcanized india-rubber BB between it and the axle-box, the only point where the grease could escape would be between the wearing faces of the two brass rings, but the elasticity of AA is found quite sufficient to keep them in sufficiently close contact, without any unduefriction. In applying the axle-box, the ring of india-rubber AA and its brass face plate are first put on the axle, and a pin is screwed into the nave of the wheel to carry round the brass plate and prevent it slipping on the india-rubber, which in such a case, would be very quickly destroyed; the axle box being then filled with the grease and the brass bearing in its place, the whole may be slipped on the axle until AA is sufficiently compressed to allow it to drop in its place.

The axle boxes are intended to be worked with the grease in ordinary use on railways; free oils must not on any account be introduced into them, as they would decompose the vulcanized india rubber.

We have seen one of the boxes which had run 6,000 miles in an express train with one greasing, and although it was but an old worn axle, which had been adapted, its state showed most satisfactorily the value of the invention. We must not neglect to mention that the trouble of examining and filling the grease boxes at every station, is by this system almost entirely obviated.

Pneumatic Pile-driving.—By Dr. Potts' pneumatic pile-driving apparatus, a hollow iron cylinder 24 feet in length, and $4\frac{1}{4}$ in diameter, has lately been sunk into dry sand on the sea shore, at Wheal Ramath Mine, Perranzabuloe, Cornwall, at the rate of 3 inches per minute.

Suspension Bridges.—It is said that the invention of suspension bridges is due to Captain Sir Samuel Brown, R.N., who, however, yields the palm of honour to a clever little architect and mechanic, who time out of mind, has been noted for industry and ingenuity—namely, the spider, who, one dewy morning submitted to the Captain a model of a suspension bridge thrown across a garden walk.

Deodorizing.—We see that some experiments have lately been made on deodorizing agents acting on stable refuse, that from a piggery, and on night-soil; and, it is added, that peat charcoal, prepared on the plan patented by Mr. Jasper Rogers, C.E. was found by far the most effective; it instantly and entirely neutralized and destroyed the whole of the offensive odour in each substance, and when the mixtures were examined two days after, they were found perfectly inodorous.

On 26th ult. the tenders for the New Prison for the County of Surrey were sent in to the magistrates, and Messrs. Locke and Nesham's contract was declared to be accepted. This prison is to be built at Wandsworth, at a cost of about £100,000.

Steam Navigation

American Line of Steamers from Panama.—Advices from Panama, 22nd November, state that the *California*, the first of the American line of steamers to ply between the port of Panama and San Francisco in California, was expected to arrive about the beginning of January, and would take the Mails for the north-west coast, to be brought to Chagres by the first of another new line of steamers between New York and that port. Panama would therefore become the central port in the Pacific, whence would depart the steamers to the south as far as Valparaiso, and to the north up to Oregon, as from San Francisco there was to be a branch to the Sandwich Isles and China, put on foot by the parties running the American line to the westward.

The repairs to the Cruces Road were to commence on the 1st January, the Royal Mail Steam Packet Company having advanced the Government of New Grenada funds sufficient for the purpose, the latter providing a corps of 200 sappers to do the work.

The seaports on the Isthmus are free, and vessels could enter and remain in them free of tonnage duties. With these advantages of situation, and extensive means of communication diverging from a central point, there appeared to be a fair opening for business in Panama.

India and China Mails.—The subjoined circular has been issued by the Peninsular and Oriental Steam Navigation Company, announcing to their shareholders the completion of a contract with the Government for continuing the conveyance of the India and China mails between Southampton and Alexandria, the termination of the contract entered into Sept. 1, 1840, taking place this day :—" London, Dec. 29, 1848.—I am instructed by the directors to apprise you, that since the presentation of their annual report to the proprietors, on the 13th inst., the Lords Commissioners of the Admiralty have made a proposal, and an agreement has been entered into accordingly, for a continuation of this company's contract for the conveyance of the India and China mails between Southampton and Alexandria, on the terms of an offer made to their lordships by the directors, in consequence of their lordships having opened the service to public tender in May last—namely, for a period of not less than four years, and afterwards until notice shall be given by either of the contracting parties to discontinue it. Payment, £24,000 for the first year, with an abatement of £500 per annum, for so long as the contract shall continue thereafter —a condition which the directors consider the gradual developement of the company's passenger and commercial traffic will enable them to afford, and which will tend to ensure the permanency of the company with the service. —I am, &c., C. W. Howell, Secretary."

The Sarah Sands.—The *Sarah Sands* has just completed her second year, ending December, 1848, having performed five voyages between the 22nd of January and the 4th of December. During the present year she has continued to run with great regularity and success. The average time outwards has been 18½ days, and homeward 16½ days—always deeply laden. Her shortest voyage outwards was 16 days, and homeward 13½ days. She has carried during the present year the large number of 1,800 passengers across the Atlantic without the slightest accident, and has delivered her cargoes in excellent order. These facts are not only interesting to those engaged in the New York trade but are of great importance to the shipping interests of this country. She will sail again on the 20th of January, and in the interval the owners are making some slight improvements in the machinery and accommodation, that will tend to make her performances still more successful.

Lights of Steamers.—The Swedish government, in order to prevent steamers from running foul of each other in the night, has issued an ordonnance that all Swedish steamers shall henceforth, from sun-set to sun-rise, carry the same lights, of the same colours, and in the same position as those agreed upon between France and England.

We see that Messrs. Joyce and Co. of Greenwich, have turned out a new halfpenny boat, "*The Emmet*," for the above-bridge station. The engines re on the oscillating principle, of 20 horse nominal power, and she has aone the distance between Blackwall and Gravesend in 70 minutes, with dtide, being just a matc i for the "Brunswick," which is a much larger boat.

Royal Steam Navy.

PROMOTIONS AND APPOINTMENTS.

Mr. C. Atherton chief engineer of Woolwich Dockyard, has been appointed chief engineer to the New Steam Establishment at Keyham Point, Devonport, and Mr. Humphries, many years managing engineer for the firm of Sir John Rennie and Co., has been appointed to succeed him as chief engineer at Woolwich Factory.

Mr. Taplin, who for many years has held the office of engineer and machinist at Portsmouth Dockyard, has been appointed to Woolwich.

Mr. Miller, who has been for some years the superintendent of engineers at Devonport Dockyard, we have already stated, has been appointed assistant to the chief engineer at Portsmouth.

Mr. Lambert, a very experienced engineer, and superintendent for many years of the marine engine business of Messrs. Maudslay and Field, has entered her Majesty's service, and has been appointed second assistant to the chief engineer at Portsmouth.

TRIALS OF NEW STEAMERS, DOCKYARD INTELLIGENCE &c. &c.

Arrogant, steam frigate, 46, fitted with auxiliary engines of 360 horse-power, by Messrs. Penn, on their direct action trunk principle, left her moorings at half-past ten o'clock on Monday, the 8th inst., having on board Capt. Fitzroy, who is to commission her on her arrival at Portsmouth ; Lieutenant Priest, who is to be the first lieutenant, and Mr. Tucker, master, who has been appointed, and had charge of the vessel, with Lieut. Robinson, assistant to Capt. Austin, C.B., to report on her performances during the voyage round to Portsmouth; Mr. Trickett, assistant to the chief engineer at Woolwich Dockyard; Mr. Casey; Mr. Allen, second master of the Black Eagle; Capt. Halsted, R.N., Secretary at Lloyd's; and several other persons. At starting she proceeded at a speed of about seven knots per hour, until opposite the measured mile, in Long Reach, when the time was taken, and the speed found to be against tide 5.886, or, making allowance for the tide, an average speed of 7¼ knots per hour, with an average number of 62 to 63 revolutions of the screw per minute. The result of the trial is the most satisfactory on record, the power of the engines being only 360 horse, and intended simply as an auxiliary, yet they gave a momentum to this splendid frigate of 46 guns of large calibre and weight equal to 7¼ knots per hour, when she had on board 246 tons of coals, 187 tons of water in tank and 13 tons in casks, drawing 18 ft. 9 in. aft, and 16 ft. 10 in. forward, with all her guns on board, the armament being heavier than originally intended, and now consisting of two 68-pounder guns of 95 cwt. each, mounted on traversing platforms and pivots, and sixteen 32-pounder guns of 32 cwt., each on the upper deck ; twelve 8-inch guns for 56 pounder hollow shot, or 68-pounder solid shot, and sixteen 32-pounder guns of 56 cwt. each for the main deck. During the trial betwixt Woolwich and Gravesend there was not a momentary stoppage of any kind, the engines being in the best working order, without a single hot bearing. The whole of the machinery is upwards of 6 feet below the water line, and the steam chest more than 3 feet, rendering the engines free from danger during warfare; and the ventilation of the engine-room has been rendered perfect by the adoption of a fan,, set in motion by a small engine of about 6-horse power, which also by one pump supplies the boilers, and by another discharges the bilge water. This engine was not required, the weather being cool, and the engine-room at a very moderate temperature, owing to the excellent system of ventilation adopted; the small engine being only intended as an auxiliary for giving a free current of air in warm climates. The Arrogant brought up for the night in Nob's Channel, and on Tuesday morning proceeded for further trial betwixt the Nore and Mouse Lights, where there is a good depth of water. A trial was made up and down between the Nore and Mouse Lights; the time occupied with tide was 49 m., against tide 64 m.— averaging 8.3 knots, engines making against wind 57 to 59, with wind, 61 to 62 revolutions. The size of the cylinder is 60 inches, length of stroke 3 feet, diameter of screw 15 feet. She then went on to the Downs, and landed Mr. Tricket, and Mr. Stuart, Government pilot at Deal, the latter having gone round Woolwich to assist Mr. Tucker in navigating the vessel. The Arrogant was opposite Deal at four o'clock p.m., on Sunday, steering for Portsmouth.

The Plumper, Reynard, and Rifleman.—We extract the following particulars of the trials of sailing of the auxiliary screw steamers from the *Times*:—

"The first trial was between the Plumper and Reynard only, under sail alone, with a head sea ; the wind, which was nearly abeam, being moderate, but varying in force. All plain sail, gaffsail, studdingsails were set. The log showed at different times a speed of 8, 7, and 6 knots. The trial began at 9h. 15m. a.m., and continued till 2. p.m., when the question, 'Who beat?' was signalled; and the answer from the two vessels was 'Equal.' In this trial, and those which followed, the Plumper was under the disadvantage of being unable to use her mainsail to full effect, owing to the funnel having been misplaced—a loss which made the two vessels unequal.

The second trial included the Rifleman with these vessels, and was performed with the united force of the wind and steam, the wind being abeam, in chase of the Admiral. In 1h. 10m. the Rifleman and Reynard (the former a little ahead) came up with the Admiral, and the Plumper was about 600 yards astern; speed between 7 and 8 knots. In this trial, in

addition to the defective set of the mainsail of the Plumper, her screw having too great a diameter, viz. 12 feet, had 32 revolutions, and the engines 13 revolutions in a minute less than with the screw originally used, viz., 6 ft. diameter; and as the screw could not run fast enough to use the steam produced, there was no slip, and, of course, the other vessels had the advantage of her in speed, whilst the manner in which she cleared the water abaft was entirely satisfactory.

In a third trial, under sail only, beginning with a moderate breeze, on a wind, the Orestes took part with the other three. Rifleman and the Reynard gained on the Plumper. But in two hours the breeze freshened, and this vessel began then to retrieve her loss. Before, however, she had time to accomplish this object, the foretopmast and maintopgallantmast were carried away, as those of the Reynard were in her first trial. The Reynard was then about 300 yards to the windward. This is one exemplification of the bad policy of sending ships to sea without allowing time to make the necessary preparations; the rigging, consisting of new rope, stretched of course, and ought to have been set up before the vessel left England but she was ordered out of port without time being allowed to stretch the rigging sufficiently.

The two auxiliary screw vessels could always work round the St. Vincent, allowing to the first-rate considerable sail; but with their present power of sail, they are not fit to compete in sailing with the 16 gun corvette.

The Admiral has received from the officers of the Plumper a report that she is the easiest ship they ever served in, and that, in a heavy sea (such as may be styled a 'Cape sea'). In scudding, her motions of rolling, as well as her pitching, are so easy, that they would not hinder the fighting of the guns. She is very stiff under sail; and it is considered in the fleet that she is superior to the Reynard in a sea."

Basilisk, steam-sloop, went down the river on Thursday the 4th inst., on an experimental trial, and returned to Woolwich in the afternoon. The experiment was successful. Her speed as tried at the measured mile at Long Reach was 12.1 knots through the water, an extraordinary rate of speed, and exceeding by two knots an hour the speed of the Niger, built from the same lines, but propelled by the screw.

Brisk, new screw propelled sloop, built from the designs of the Committee of Construction, has had her keel laid down on the slip from which the Basilisk was launched.

Kingston's Valves.—Mr. Maurice Johnson, engineer of the *Firebrand* steam-vessel, who recommended the application of Kingston's valves to the bottoms of vessels to aid in extinguishing fires, has been ordered to forward drawings of the plan he has suggested for the inspection of the Admiralty. The plan Mr. Johnson proposes is merely to admit the water through one of Kingston's valves, which can be regulated with the greatest nicety to any quantity, and conducted round both sides of the vessel in pipes, perforated on the upper side, and running parallel a short distance below the water line. On the valve being opened the water would escape from the perforated pipes, and running down the sides of the vessel extinguish any fire existing below the water line. The water can afterwards be easily pumped out on the valve being shut. As a proof of the advantage of admitting water into vessels by Kingston's valves for the purpose of rendering them sweet and healthy, Mr. Johnson, previous to the sailing of the *Blazer* for the West Indian station, admitted about two tons of water at a time, pumping it out as it mixed with the bilge water until it was pumped out nearly pure. The good effect of the plan was evident by the health enjoyed by the crew, as only one boy died during the period of 22 months the vessel was employed on the station at the West Indies.

Steam Reserve.—The Admiralty have decided upon forming a reserve of steam vessels at Devonport, on the same plan and under the same arrangements as at Portsmouth. A captain of the Royal Navy, with a small staff, will be appointed to superintend them. Mr. Atherton, the chief engineer at Woolwich has already been appointed to form the engineer establishment. Moorings for eight steamers are ordered to be laid down. Conflict, 8 guns, 1,013 tons, 400 horse-power; Virago, 6 guns, 1,060 tons, 300 horse-power; Spiteful, 6 guns, 1,050 tons, 280 horse-power; Growler, 6 guns, 1,059 tons, 280 horse-power; Salamander, 6 guns, 816 tons, 220 horse-power; Rattler, 6 guns, 890 tons, 200 horse-power; Jackal, 2 guns, 345 tons, 150 horse-power. A block-ship will soon be appointed for the Captain-Superintendent and the staff of the squadron.

The Portuguese steam frigate, "*Infante D. Luiz*," formerly "Royal Tar," has arrived in London for extensive repairs both to the vessel and engines, and to receive new tubular boilers by Messrs. J. and A. Blyth, of Limehouse, in place of her former flue boilers. Messrs. Green of Blackwall, are effecting the repairs to the vessel.

Railways.

London and North-Western Railway.—We have just learnt that a very important addition to the comfort and convenience of the travelling public has been suggested by the general manager of the company, Capt. Huish, and is likely to be brought into early operation. Our readers may have observed, that at the principal stations there are bookstalls, where popular literature as well as newspapers can be purchased. The supply of books is about to be increased and improved in character; and the whole of the stations on the line being undertaken by one party (Messrs. Smith and Son, of the Strand,) Capt. Huish proposes to establish a gigantic circulating library, on the plan that the passenger may select a book at a stall, paying the price thereof, and after travelling any distance on the railway, (where his journey terminates) deliver it at the station, receiving back the value, less a trifle for the perusal. When it is considered that the London and North-Western railway extends over nearly 500 miles, and that more than six millions of passengers travel upon it annually, we cannot conceive any plan more likely to wile away a tedious hour, and improve the time necessarily spent in journeying.—*Chronicle.*

England.—The aggregate length of new railways opened during the year 1848 was 750 miles, consisting of branches and portions of main lines belonging to the following railways:—Bristol and Exeter, 5 miles; Blackburn, Bolton, and West Yorkshire, 9; Chester and Holyhead, 80; East Anglian, 21; East Lancashire, 20; East Lincolnshire, 48; East and West Yorkshire, 16; Eastern Counties, 30; Eastern Union, 3; Great Northern, 69; Great Western, 31; Lancashire and Yorkshire, 84½; Leeds and Thirsk, 10; Leeds and Dewsbury, 20; Liverpool Crosby and Southport, 14; London and Brighton, 10; London and South-Western, 24½; London and North-Western, 7; Newmarket, 18; North-Western, 6; Manchester, Sheffield, and Lincolnshire, 57; Midland, 57; North Staffordshire, 29; Shrewsbury and Chester, 28; South Devon, 27; York, Newcastle, and Berwick, 7; York and North-Midland, 24½ miles.

Scotland.—The aggregate length of new railways opened was 299 miles, belonging to the following railways:—Aberdeeen, 17½; Caledonian, 84; Dumfries and Carlisle, 24; Edinburgh and Glasgow, 9½; Edinburgh and Northern, 40; Glasgow and Ayr, 36½; Glasgow, Barrhead, and Neilston, 8½; North British, 16; Scottish Central, 46; and the Scottish Midland, 33.

Ireland.—The aggregate length of new railways opened was 158 miles, belonging to the following railways:—Belfast and Ballymena, 38; Belfast, and County Down, 4½; Great Southern and Western, 44; Irish South Eastern, 10¾; Midland Great-Western, 14; Ulster, 11; Waterford and Kilkenny, 11; and Waterford and Limerick, 25.

It would appear, therefore, that the aggregate length of new lines opened for traffic in the United Kingdom during the past year was 1207 miles.

Statistical Returns of Foreign Railways in 1849.—The following is from the official return of the length of the whole of the railways on the continent:—1. France, 2000 kilometres.—2. Germany, 5392.—3. Belgium, 795.—4. Holland, 260.—5. Denmark, 195; ditto, comprising the duchies of Schleswig and Holstein, 990 kilometres—viz.; 240 open, 16 nearly finished, and 734 kilometres projected.—6. Switzerland, 125.—7. Italy, 260.—8. Hungary, 250.—9. Russia, 180.—10. Poland, 300.—10,552 kilometres, or 2110 leagues. A great number of branch lines are in course of construction (and projected) throughout the continent; but, from the present unsettled political state of Austria and other parts of the north of Europe and Italy, added to the very great scarcity of money generally in France, and other dominions, railway progress and speculation have, for a time, become at a standstill. For Spain there is only, as yet, a short line from Barcelona; but Portugal, Turkey, &c., are without any whatever.

Dublin and Belfast.—It is stated that Government have determined on making an advance to the Dublin and Belfast Junction line of 300,000*l.*, the amount necessary to complete it. The ground on which this assistance is to be rendered is, that as the Great Southern and Western of Ireland, the great trunk line to the south, has been accommodated by the Government with the loan of half a million, it would not be dealing impartially to withhold similar assistance to the Dublin and Belfast, which is the great trunk line to the north.

South-Eastern.—The trains now run right into the harbour terminus at Folkestone, to the steam-boat station, thus materially accelerating the continental transit. A great swing bridge has been thrown across the quay constructed for this purpose. The company are about to enlarge their station accommodation in this quarter, with the view of making Folkestone their great water terminus.

The first section of the Demerara Railway has just been opened, and the planters are availing themselves largely of the facilities it affords for the transmission of sugar, &c., from their estates.

CALIFORNIA.

The production of gold has, at all times, been a matter of great commercial moment; but at no period has the attention of the world been so generally directed to the subject as at present, in consequence of the wonderful discoveries in California. By many it is feared that the quantity already found, and said to exist, will disturb the currency, and thoroughly derange all mercantile arrangements and transactions; but, for our own part, we do not apprehend anything of the sort. It is a fallacy to do so. We believe in the reports from California, and believe likewise, that there great quantities of the valuable metal still to be brought to light; but, after all, gold is merely worth its value. The enormous cost of all necessaries of life and mining labour in California, will not admit of the extraction of the gold at a rate to diminish its present standard; added to which, an enormous population will be rapidly established in the country, which of itself, will be sufficient to absorb the gold for the necessary requirements of trade and commerce. Although there is no doubt that vast quantities of gold have been, and continue to be, drawn, we must not suppose that the whole surface of immense tracts of territory contains the precious metal. The gold is obtained from the bottoms and sides of rivers, and the beds of ravines and brooks, which are filled up in the wet season, and which for centuries have been the repositories of the debris of gold formations washed down from the hills. It seems quite similar to the tin streams of Cornwall, where this useful metal is found in great abundance in the stratum of sand, under the bog, or turf, in the low ground between the hills. So is it found in California and in the same strata—viz. friable or decomposed granite.

When we read of the existence of a trench 100 ft. long, 3 ft. wide, and 2 ft. deep, yielding 17,000 dollars of gold, we can believe the fact; but as the locality is not described, we presume that the trench was made in the bed of a winter torrent, and that the soil, a few yards from it, would not show gold. About 120 years since, certain adventurers from the province of St. Paulo, in Brazil, discovered the mines in Minas Geraes. They washed up the bottoms of brooks, until the cessation of gold in the gravel, or sand, proved the more productive gold-bearing veins, or fissures, to be near, and thus, among many others, the riches of Gongo Soco first came to light. From the vast extent of territory in California said to produce gold, it is probable that some years will elapse before the surface deposits are exhausted; but when the first fever shall have passed away, with the surface riches which caused it, attention will be drawn to the fountain of this scattered wealth. The mountains will be explored, and lodes, no doubt, will be confidently sought for, whose riches, washed away and concentrated by the elements during centuries, have been spread over the adjacent plains.

All this, however, takes time. With it population increases, new settlements spring up in all parts of the world, trade and commerce expand, an extended currency is required; and therefore, we again repeat our conviction that the currency will not be disturbed by the present discoveries. Besides, we feel assured no lodes will be found, the strata is against it. The gold is purely washings from the granite mountains, which contain gold throughout, but which will necessarily take centuries to accumulate in any quantity. After all, what is the amount of gold found, as compared with the currency of the world? It is as nothing. It is not equal to the falling off in the productions generally, of South America. It is not equal to the existing and increasing demand for gold, for works of art or of luxury. So far from being alarmed by the California riches, with respect to the standard of gold, we are inclined to consider them merely as keeping pace with the requirements of the times, and will, no doubt lead, and justly, to the more energetic workings of existing gold companies, and probably to the formation of new undertakings for the purpose.

As there is considerable similarity between the gold deposits in California and those which enriched the Paulistas in Brazil, an analysis of the most successful of the English mining companies established in that empire will be interesting to our readers; we allude, of course, to the St. John del Rey Mining Association. This company work three mines contiguous to each other, and drained by the same water-wheel; the lode in two of the mines varies in width from 8 to 32 ft., averaging 14½ ft.; and the third, the Gamba, 4 ft. 7 in. The lodes dip bodily at an angle of 46 deg., at which incline the pumps are carried, and on the same plane the kibbles from the stopes under the inclined shaft, are hauled to surface. There are two water-wheels for drawing stuff—one for the saw-mill, and one at the reduction-house for working the amalgamation barrels, working 96 heads. The whole body of the deposit, between the walls, gives gold, yielding in different sections 2½ to 5⅓ oitavas to the ton—104 oitavas being equal to 1 lb. troy. In the Gamba mine, lines of quartz, running into the country, broken for the convenience of working, give 1 to 1½ oitavas; each section of the mine is very regular in its contents. The average produce for 1847, was 4·21 oitavas per ton, which was worth in London (nett) 7s. 7d. per oitava, or 39*l.* 16s. per lb. troy. A cubic fathom of the deposit contains something more than 20 tons; and each fathom sunk in the three mines admits of about 9,000 tons being broken, and the stopes kept in order. Westward, a continuation of the deposit near the surface has lately been ascertained, and is already opened upon, to the extent of 19 fms., from 8 to 12 ft. wide, which adds further to the resources of this magnificent mine. This new ground is close to the stamps; and there is no doubt, we are assured, of its continuance westward, as there are considerable excavations of the "old" people in that direction. This mine is now giving a clear profit of above 3,000*l.* per month; and, humanly speaking, a great increase is certain, as a powerful set of new stamps has just been completed. This is undoubtedly a most satisfactory state of things for the shareholders, and will enable them to receive frequent and good dividends; but what is it in comparison with the metallic circulation? And should the production continue to increase to the fullest expectation, or were there are many other mines equally remunerative and yielding, we should not for a moment apprehend any alteration in the metallic currency of the world.—*Mining Journal.*

The Sandwich Island paper, the *Polynesian*, the recent numbers of which contain constant references to California, gives a series of instructions to passengers in crossing the Isthmus from Chagres to Panama, by a party well acquainted with the route, which convey a vivid idea of some of its characteristics :—

"Arrived at Chagres," he says, "get your luggage passed at the Custom-house, and proceed up the river as soon as possible. Before starting, however, see that the awning of your canoe is in good order, and covered with tarpauling, and also that the bottom of the canoe is properly "dunnaged,' that is, laid with long strips of wood to keep your luggage or bed from getting wet, should it rain or the canoe leak, during your passage up the river to Cruces. Provide a mattrass and bolster to spread under the awning. Stow your luggage so as to keep the ends of your awning open; you will thus preserve a free circulation of air, and find the temperature less oppressive.

"Your canoe men will often be inclined to stop. You must object, however, to their doing so. Give them time to breakfast; they will afterwards eat something probably during the day in their canoe, and dine or sup when you stop for the night. It is advised that you sleep in your canoe. Should you, however, decide upon passing the night in one of the huts which are to be found on the banks of the river Chagres, you must provide yourself with a hammock either at Carthagena or at Chagres. They are to be bought at from either 4 doll. to 8 dolls. each. Ask the steward of the steamer which conveys you to Chagres to prepare you a basket of provisions sufficient for three days. Provide yourself with an 'Etna' and a couple of soda water bottles full of spirits of wine. Take also a corkscrew, half a dozen wax candles, a lantern, a tin box of lucifer matches, and a tin mug to drink from. The water of the river Chagres, a few miles above the bar, is fresh, clear, and agreeable to the taste. Do not be tempted to bathe, however, on any account, the under current being very strong and dangerous, and the risk from alligators, with which the river abounds, considerable.

"If your store of provisions fail you, fowls and eggs are to be procured; milk, too, may generally be procured in the morning at most of the 'ranchos' or huts on the river; your canoe-men will show you where. Never travel in your canoe on the Chagres at night if you can avoid it, as the river abounds with rapids, trunks of trees, &c., which render the passage up or down the stream dangerous after dark. Also be careful to eat or drink something in the morning before starting, as a preventative against the raw fog which generally then prevails.

"Efforts will be made to induce you to stop at Gorgona, and not to proceed to Cruces. Do not be prevailed on, however, but continue to Cruces, the road thence to Panama being shorter and better. In the rainy season the Gorgona road is impassable; the Cruces track is available all the year, and except that it is rougher from being more stony, it is in every respect far superior.

"Tarpauling covers should be fitted to your portmanteau and other luggage before you leave England, or your clothes will probably get soaked through. An European, unused to the climate of the Isthmus, can have no idea of the torrents of rain which fall there. A light oil silk cloak is of great use.

"Arrived at Panama, proceed at once to the Custom-house with your luggage, and then take up your quarters at Posada del Istmo till the packet sails."

Analysis of Books.

The Student's Guide to the Locomotive Engine. Illustrated by Seventy-Two copper plate engravings. London: J. Williams & Co., 1849.

This is essentially a practical work, containing the details of the engines of Stephenson, Bury, Hawthorne, Jackson, Sharp and Roberts, Cave, and others, and affords a valuable comparison of the designs of the various makers. We have not space this month to go more into detail, but shall not fail to return to the volume.

Analysis of Patents.

Charles Attwood, of Wolsingham, Durham, *for a certain improvement or improvements in the manufacture of iron.* Patent dated April 18, 1848.

This invention has relation to improvements in smelting, or preparing for smelting such portions of iron ore, as are broken small or in a comminuted or pulverulent state, so that the ore falls through the fire to the bottom of the blast furnace, before sufficient time has been allowed to elapse to properly reduce and combine or cement such comminuted particles, with the necessary carbon, slag, or other substances, usually mixed with iron ores in smelting, as forge cinders, mill cinders, and finery cinders, may also be similarly treated. For the purposes of this invention, the patentee employs that sort of coal only that has a tendency to agglutinate or run together whilst coking; with his coal he mixes a quantity of the ore in a comminuted state, in the proportion of above one fourth of the weight of the coal; the mass thus mixed, is afterwards coked in the ordinary way of coking for smelting purposes, when the ore so mixed becomes involved in the body of the coke, by which it is retained till freed from the coke by the subsequent process of smelting. It will be seen that ore thus combined cannot fall through the blast furnace faster than the coke with which it is in combination; it will therefore have plenty of time to combine with carbon to the required extent, ere it reaches the bottom of the furnace. As regards the size of the particles of ore that will be benefited by such treatment, anything from the size of a large walnut down to the smallest particles of dust will be proper to be subjected to such combination previous to coking, but anything materially larger, it would be quite unnecessary to subject to such treatment, as it becomes properly reduced in the ordinary method of smelting iron.

The patentee states that he finds coke formed of that sort of coal before mentioned, found in Durham and Northumberland, will after being coked in the manner described, and combining with it one quarter of its weight of ore or slag, bear a burden of ore in the ordinary manner of charging the blast furnace equal to the same weight of coke without such combination of iron ore; it therefore is improved to a very considerable degree, independantly of the advantage derived from a proper reduction of the smaller particles of ore effected by this process.

The advisability of reducing some portions of the ore in the event of the comminuted portions of the bulk not yielding the proportionate amount, is left to experience; but as the pulverizing ore or the slag or cinders beforementioned may be cheaply and expeditiously effected, the patentee thinks such an alteration would be attended with considerable advantage. In the lighter description of iron ores, the tendency to fall through the coke in smelting, is not so apparent as in some of the heavier sorts, such as red or hœmatite ores; the smaller portions of these find their way to the bottom before being properly reduced, and therefore afford the best opportunities for this method of preparing the smaller particles thereof. In smelting ores with coke prepared in this manner, it is necessary to employ the usual quantity of lime or flux, but which it will be better to omit in the previous treatment of the coke and ore, as it would only detract from the necessary qualities of the coke; it will therefore be necessary to employ it in the smelting as in the ordinary way.

James Derham, of Bradford, Yorkshire, Manager, *for certain improvements in machinery for carding, combing, preparing, and spinning cotton, wool, alpaca, mohair, flax, silk, and other fibrous materials.* Patent dated April 10, 1848.

This specification is so lengthy, that we can only give an outline of its contents. It consists, First, of improvements in carding machinery and apparatus. Secondly, in various improvements in machinery for combing. Thirdly, in improvements in machinery for preparing and drawing, and, Fourthly, in improvements in machinery for spinning.

Under the first head the patentee claims, the communicating to the feed bands of carding engines, a tremulous or vibrating movement, whether such tremulous or vibrating movement, be with feed bands which are perforated, or not. The object of this motion being, to separate the dirt and other extraneous matter from the wool, which would otherwise be carried into the machine. Also, the peculiar construction of metallic feed bands described. The application to carding machinery of apparatus described, whereby he is enabled to oil, steam, and heat the wool as it is passing into the carding engine. The employment of troughs to receive the dirt, thrown from the wool, to prevent its again reaching the wool. The employment of perforated steam tubes to damp the wool, in dry weather. The constructing carding engines, so that the several swifts shall be made to work at different velocities, the velocity being greater, the nearer they are placed to the doffing cylinder.

Under the second head, the patentee claims, various arrangements of machinery for feeding the combs of combing machines, also, improved arrangements for holding and working the combs, and of heating them with gas, to avoid soiling them.

Under the third head, the patentee claims, certain improvements in that kind of preparing machinery, known as screw-gill machinery. Under the fourth head the patentee claims, First, the obtaining a differential speed for spinning machinery, by the employment of a friction roller covered with vulcanized india rubber, and revolving in contact with a friction disc, covered or not with the same material, when such friction roller is capable of approaching to and receding from the centre of the friction disc. Secondly, the arrangement of escape movement, for effecting the traverse of the friction roller. Thirdly, the obtaining of a differential speed for spinning machinery, by the employment of inclined bars, or other analogous means, in connection with an expanding driving drum, whereby the segmental pieces, which form the periphery of the driving drum, may be kept at any given distance from their common centre, and may be allowed to advance to, or recede from their common centre as required, in order to change the diameter of the driving drum. Fourthly, the constructing expanding driving drums of segmental sliding pieces, the whole being surrounded by an elastic periphery of vulcanized india rubber. Fifthly, the general arrangements of machinery whereby the surface speed of driving drums may be changed when such drums are driven at a continuous uniform speed.

Félicité Raison Selligue, of 6, Boulevarde Beaumarchais, Paris, widow, *for certain improvements in propelling, and the machinery employed therein.* (Being a communication from her late husband.) Patent dated May 4, 1848.

The nature of this invention consists in obtaining a mechanical power from the inflamation of hydrogen gas mixed with the necessary quantity of atmospheric air required to render it explosive, also in the machinery suitable to the application thereof to motal purposes generally. It is preferred to employ hydrogen gas alone, or in combination with other gases to render it cheaper; other explosive gases however may be substituted and employed in the same manner as hydrogen gas. The patent right is claimed as regards the propelling or moving of bodies and machines, by the power resulting from the explosion of a due admixture of hydrogen or other inflammable gas with atmospheric air, such power being generated, regulated, and applied as described.

John Strang Harradine, of Holywell-cum-Needingworth, Huntingdonshire, farmer, *for an improved mode of fitting certain girths and straps.* Patent dated April 20, 1848.

This invention refers to the application of elastic straps to a variety of purposes, as saddle girths, in which the improvement consists in having straps of vulcanized india rubber, with one end secured to the saddle tree or saddle framing, and the other end attached by ordinary leather buckle straps, suspending them in the usual position between the flaps of the saddle. Elastic straps for the legs of trousers are formed, by attaching them to a light metal frame, with a vertical slide and a knob to secure it to a hole in the boot, or to a metal tag attached thereto, the flexible material being attached to the bottom of the metal frame and passing over a small roller at top, returns and is secured to the slide which is then drawn towards the top, one frame being secured to each side of the trouser leg, and the slide knobs secured to the boot on each side. Straps for waistbands of trousers consist in the introduction of a strip of vulcanized india rubber, of a length sufficient to draw the trowsers when buttoned tightly over the hip. Straps for gaiters consist in the introduction of similar substance, so as to come just over the instep, each end being provided with a loop or stud, to be attached as in the trowser straps. Elastic straps for articles of dress consist in the introduction in the necks of coats, cloaks, &c., of a similar strap to that used for trouser legs. Another strap consists of a piece of elastic substance enclosed in a tube, being attached thereto at one end, and having a hook at the other, which passes through a slot in the tube, and similarly applied as the last. A third description of strap consists in a piece of material inserted between the lining and exterior of the garment, one end projecting, being provided with a button or button hole and fastened in the ordinary manner.

Straps are applied as substitutes for metal springs in carriages, in which case the axle is placed between two guides, the same as the axle guard in railway carriages, which guides have three or four rollers, projecting from the side, over which an elastic strap is passed so as to cross and re-cross above the axles; one end of the strap is to be fixed while the other is carried to the axle of a ratchet wheel and over, for the purpose of tightening

when required. When the vehicle is light, the axle will rest on the lower crossing of the strap, but as the weight is increased it will come successively on the others. The modifications of this part are too numerous to be separately described. Straps are applied to letter clips or holders somewhat in similar manner to the ordinary envelope or letter stand, but having one side removed, and the partitions at a sufficient distance to receive a letter flatways; along the back edges of the partition a strip of vulcanized india rubber is stretched; between this and the back the letters are placed, and are retained in a vertical position, and from the elasticity of the india rubber each division may be completely filled, and the letters are retained in the same; this strip of elastic material being near the bottom, the superscription of either letter may be examined without removing it from the holder. Another improved holder is for affixing bills, such as play and auction bills, which only require temporary exhibition. This is simply four short pieces of wood, one being placed at either corner, they are hinged at one end to the surface against which the bill is to be posted, the other end being drawn into close contact therewith, and by that means holds the bill.

The different modes of fitting elastic straps as described are claimed under this patent.

Joseph Orsi, of Guildhall Chambers, Gentleman, *for certain improvements in the manufacture of artificial stone, cements, ornamental tiles, bricks and quarries.* (Being a communication.) Patent dated March 22, 1848.

Two separate compositions are used for these purposes, the first being what the patentee denominates brown lava, is to be used in the manufacture of pipes, slabs, troughs, and other similar and coarse articles. And the other called ornamental lava, it is proposed to use in the manufacture of tiles, bricks, and such like articles which require to be ornamental. The first of these compositions is made of the following materials, namely, gravel, or stone broken into small pieces, three parts; pounded chalk, two parts, tar, one part, and wax one tenth part. These materials are prepared by first melting the tar by heat in a suitable vessel, and then adding the others successively, incorporating them well together; they are afterwards when still in a heated and fluent state, cast into suitable moulds to form the articles required. When pipes are required to be made from this combination of materials, the patentee proceeds differently, the materials being mixed together as before described, a core or rod of wood is to be wrapped over with paper, for the purpose of preventing the adhesion of the composition. The composition, while in a fluent or heated state, is spread upon a proper table, and the core is rolled upon it, and thus takes up a portion of it. This is done until there is such a quantity as is about equal to one half of the thickness of the intended pipe, upon the half formed pipe are then placed in a longitudinal direction, three bars or ribs of iron, at equal distances apart; these are to be bound to the half formed pipe by means of wire. The rolling over the composition is now to be continued, until the ribs of iron and the wire are covered, and the surface smooth. When the pipe is complete it is allowed to cool, when it will be fit for use. The ornamental lava is thus composed:—marble broken into small pieces, three parts, ground flints, two parts, resin, one part, and wax one tenth part. Coloring matters for giving the requisite tints and colors to the composition, two tenth parts. These materials are heated and mixed in a similar manner to the first composition before described, and cast into moulds for making the articles, but for the purpose of making tiles, which shall have the face ornamented with various colors, the patentee proceeds as follows. The centre piece is first cast in a mould of the requisite color, this piece is then taken from the mould, and placed in another and a larger mould, and the color cast around it, which adheres closely to the enclosed piece, and then removed and placed in another mould and another color cast, and so on, dependant upon the number of colours required. The surface of the tile is afterwards finished and polished in the manner ordinarily in practice by marble workers.

The patent right is claimed in regard to the invention above described.

Charles Fielding Palmer, of Birmingham, *for a new or improved chalybeate water.* Patent dated April 27, 1848.

This invention relates to making an artificial chalybeate water, wherein the basic salt of protoxide of iron is held in solution in water impregnated with carbonic acid gas. For the effecting this object the following ingredients are used, 4 parts (by weight) of proto-sulphate of iron, $1\frac{1}{2}$ parts of acetic acid, 40 parts of water, and 20 parts of syrup, which are combined thus: the acetic acid being first dissolved in the water, the proto-sulphate of iron is then added, and afterwards the syrup, and the combination is then put into several bottles, the quantity put into each being small, and dependant upon the strength required. The patentee states he generally makes it of two separate degrees of strength, the first having the proportion of two grains of proto-sulphate in each bottle of four fluid ounces, and the other having double that quantity of the proto-sulphate; the bottles are then nearly filled up with a solution containing carbonate of soda, and carbonate of potash, impregnated with carbonic acid gas, and are then to be corked under pressure to retain the carbonic acid gas in the usual manner. The patentee does not confine himself to the use of acetic acid in the manufacture, as tartaric acid may be used. The patentee claims, the making a solution in which any neutral or basic proto-salt of iron in conjunction with any other salt, is held in solution in water charged with carbonic acid gas, which solution yields a precipitate upon the application of heat.

Thomas Edmondson, of Manchester, Machinist, *for improvements in making and numbering railway and other tickets, and surfaces, and in arranging and distributing tickets.* Patent dated April 27, 1848.

This invention has relation to the printing and numbering of tickets, for railway and similar purposes, and printing and marking the proper marks and numbers upon the tickets with greater accuracy, and consists of improvements in machinery for effecting the same purposes described in the specification of a former patent, granted to Mr. Edmondson in 1840. The first of these improvements has for its object the better inking the types, by means of a belt or strap, which conveys the ink from a trough or receptacles, to the inking rollers. The second improvement is in the apparatus, by the action of which, the first nine numerals are printed consecutively, without the necessity of employing the zero before them, as in the machinery at present used. The third improvement is for suspending, by self-acting means, the supply of the blank tickets to the machine, when any number less than ten thousand has been printed. The fourth is for driving the machine, and giving motion to the various parts of it, by the agency of steam or other first mover, in lieu of hand labour, which has been the only power employed for the purpose heretofore. The fifth is for a peculiar construction of receiver for the printed tickets, after having been numbered. This consists in forming them of metal, and of the arrangement described in place of those usually employed, and which are constructed of metal and wood. The sixth, is for the form and arrangement of the case for containing the tickets. The seventh, is for marking the tickets with the view of denoting the date at which they are issued. This is accomplished by cutting or stamping devices or marks in the ticket. The eighth is for the application of a trough (for containing the ink) for supplying the machine, the bottom whereof is made moveable, so as to regulate the supply.

The patentee claims, first, the employment of the strap or belt, for the purpose of bringing the ink from the trough containing it to the inking rollers, whether the same be applied to the improved machine or to any other machine employed for printing or marking railway or other tickets or surfaces. Secondly, the constrnction of the apparatus for printing or marking the units in machines for printing railway or other tickets or surfaces as described. Thirdly, the mode described of stopping or suspending the supply of tickets to machines for printing such tickets. Fourthly, the driving machines for printing railway or other tickets or surfaces by means of steam or other power in place of hand labour as described. Fifthly, the constructing tubes or receptacles for depositing the tickets of metal in the manner and form described. Sixthly, the form and arrangement of the case for containing railway and other tickets. Seventhly, the mode of marking railway or other tickets by cutting or stamping devices or marks in them to denote the date as described. Eighthly, the application to machines for printing railway or other tickets, of a trough to contain the ink, such trough having a moveable bottom as described. Ninthly, the arrangement and construction generally of the machine for printing railway or other tickets or surfaces.

Mark Smith, of Heywood, Lancashire, Power-loom Maker, *for certain improvements in looms for weaving* Patent dated May 11, 1848.

This invention is claimed to consist in, First, the general construction and arrangement of the parts forming the apparatus for changing the position of the shuttles, and the use of pins of different lengths, and guide plates when applied to a jacquard apparatus, and also the use of pins of different lengths when applied to the links of the chain of a jacquard apparatus, with the view to effect the same object. Secondly, the arrangement for stopping the movements of the loom when the weft thread is broken. Thirdly, the combination and arrangement of levers and catches, actuated by pins of different lengths, in combination with a jacquard apparatus, for varying the position of the shuttles as arranged in circular shuttle boxes. Fourthly, the application of a tappet and forked lever, when employed in combination with pins of different lengths, and a jacquard apparatus for varying the position of the shuttles. Fifthly, the positive self acting apparatus for unwinding the warp from the warp beam, used in connection with apparatus for stopping the movements of the loom. Sixthly, the construction of self-acting temples for stretching the cloth.

LIST OF ENGLISH PATENTS.

Granted from 15th December, 1848, to the 18th January, 1849.

Joseph Eccles, of Moorgate Fold Mill, in the County of Lancaster, cotton spinner, and James Bradshaw, and William Bradshaw, of Blackburn, watchmakers, for certain improvements in, and applicable to, looms for weaving various descriptions of plain and ornamental fabrics. Patent dated December 15th, 1848; six months.

William Wharton, superintendant of the carriage department at the London and North Western Railway Station, Euston-square, for certain improvements in the construction of vehicles used on railways, or on other roads and ways. Patent dated December 16th, 1848; six months.

Henry Walker, of Gresham-street, London, needle manufacturer, for certain improvements in the process, or processes, of manufacturing needles. Patent dated December 16th, 1848; six months.

William Wild, of Salford, Lancashire, moulder, for certain improvements in rotary steam-engines. Patent dated December 16th, 1848; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in casting printing-types, and other similar raised surfaces, and also in casting quadrates and spaces. Patent dated December 16th, 1848; six months.—(Communication.)

William Clay, of Clifton-lodge, in the County of Cumberland, engineer, for improvements in machinery for rolling iron, or other metals, part of which improvements are applicable to other machinery in which cylinders or rollers are used. Patent dated December 16th, 1848; six months.

Joseph Deeley, of Newport, in the County of Monmouth, engineer, for improvements in ovens and furnaces. Patent dated December 16th, 1848; six months.

Edward Smith, of Kentish-town, Middlesex, window-blind manufacturer, for improvements in window-blinds, and in springs applicable to window-blinds, doors, and other like purposes. Patent dated December 16th, 1848; six months.

William Major, of Culchett, near Leigh, Lancashire, manufacturer, for mprovements in looms for weaving certain descriptions of cloths. Patent dated December 16th, 1848; six months.

John Cartwright, of Sheffield, joiner's tool maker, for an improved brace, for the use of carpenters aud others. Patent dated December 16th, 1848; six months.

John Chirton, of Greek-street, Soho-square, in the County of Middlesex, professor of music, for improvements in flutes. Patent dated December 16th, 1848; six months.

Thomas Dickins, of Middleton, in the County of Lancaster, silk manufacturer, for certain improvements in machinery or apparatus, for warping and beaming yarns or threads composed of silk, or other fibrous materials. Patent dated December 21st, 1848; six months.

William Wilkinson, of Dudley, in the county of Worcester, manufacturer, for a certain improvement, or certain improvements, in the construction and manufacture of vices. Patent dated December 21st, 1848; six months.

William Curtain, of Retreat-place, Houseland, gentleman, for certain improvements in the method of manufacturing Brussels tapestry, Turkey, and velvet, or cut-pile carpets and velvets, silk, linen, mixed cloths, and rugs of all descriptions, by which method less warp is required, and perfect and regular figures or patterns are produced. Patent dated December 21st, 1848; six months.

John Travis, and John Mc Innes, of Liverpool, lard refiners, for improvements in packing lard. Patent dated December 21st, 1848; six months.

James Henry Staple Wildsmith, of City-road, experimental chemist for improvements in the purification of naphtha, (likewise called wood-spirit, and hydrated oxide of methyle,) pyroligneous acid, and enpion, and certain other products of the destructive distillation of wood, peat, and certain other vegetable matters, and of acetate of lime and shale, and in the purification of coal tar and mineral naptha, likewise spirit, being the product of fermentation. Patent dated December 21st, 1848; six months.

Charles Augustus Holm, of King William-street, in the county of Middlesex, civil engineer, for improvements in printing. Patent dated December 21st, 1848; six months.

Pierre Armand le Comte de Fontainemoreau, of 4, South-street, Finsbury, for certain hygienic apparatus and processes for preventing and curing chronical and other affections, and to prevent or stop certain epidemic diseases. Patent dated December 21st, 1848; six months. (Communication.)

John Penn, of Greenwich, in the county of Kent, engineer, for certain improvements, in steam-engines, of the kind or class, commonly called marine steam-engines. Patent dated December 21st, 1848; six months.

William Baker, of Edgebaston, near Birmingham, in the county of Warwick, civil engineer, and John Ramsbottom, of Longsight, near Manchester, engineer, for impovemenats in the construction of railway wheels and railway turn-tables, which latter improvements are applicable to certain shafts or axles driven by steam or other motive power. Patent dated December 21st 1848; six months.

William Riddell, of Whitefriar-street, in the city of London, gentleman, for improvements in the construction of ever-pointed pencils, writing and drawing instruments, and in inkstands or inkholders. Patent dated December 21st, 1848; six months.

Charles Low, of Roseberry-place, Dalston, gentleman, for improvements in smelting copper ore. Patent dated December 28th, 1848; six months.

Georg Fergusson Wilson, of Belmont, Vauxhall, gentleman, and Charles Humfrey, of Manor-street, Old Kent-road, merchant, for improvements in the production of light, by burning oleic acid in lamps, and in the construction of lamps, and manufacture or preparation of oleic acid for that purpose. Patent dated December 28th, 1848; six months.

William Dingle Chowne, of Connaught-place-west, M.D., for improvements in ventilating rooms and apartments. Patent dated December 28th, 1848; six months.

Moses Poole, of the Patent Bill Office, London, gentleman, for improvements in the manufacture of heels of boots and shoes; of swivels; of bag fastenings; of revolving furniture; and of the connection of pipes for gas and other fluids. Patent dated December 28th, 1848; six months.—(Communication.)

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner, farmer, of Lyon's Wharf, Upper Fore-street, Lambeth, for improvements in smelting copper. Patent dated December 28th, 1848; six months.

Israel Kinsman, late of New York, but now of Ludgate-hill, merchant, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluid. Patent dated December 28th, 1848; six months.

William Edward Hewton, of Chancery-lane, civil engineer, for certain improvements in steam-engines. Patent dated December 28th, 1848; six months.—(Communication.)

Robert Jobson, of Holly Hall Works, near Dudley, in the county of Stafford, engineer, for improvements in the manufacture of stoves. Patent dated December 28th, 1848; six months.

William Gilmour Wilson, of Port Dundas, Glasgow, engineer, for improvements in the formation of moulds, and cores of moulds, for casting iron and other substances. Patent dated December 30th, 1848; six months.

William Knapton, of the city of York, iron-founder, for certain improvements in the mode of manufacturing gasometers or gas-holders. Patent dated January 3rd, 1849; six months.

William Thomas, of Cheapside, in the city of London, merchant, for improvements in the manufacture of window-blinds. Patent dated January 4th, 1849; six months.—(Communication.)

David Yoolow Stewart, of Montrose, in the kingdom of Scotland, iron-founder, for improvements in the manufacture of moulds and cores for casting iron and other substances. Patent dated Januury 4th, 1849; six months.

Henry Francis, of Chelsea, engineer, for improvements in sawing and cutting wood. Patent dated January 4th, 1849; six months.

Robert Munn, of Starch Head Mill, near Rochdale, in the county of Lancaster, cotton spinner, for certain improvements in looms, and apparatus connected with looms, for weaving various descriptions of textile fabrics. Patent dated January 4th, 1849; six months.

Willim Crofton Moat, of Upper Berkeley-street, Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. Patent dated January 4th, 1849; six months.

John Coope Haddan, of 29, Bloomsbury-square, civil engineer, for an improvement or improvements in railway wheels. Patent dated January 5th, 1849; six months.

Miles Wrigley, of Ashton-under-Lyne, architect, for certain improvements in the manufacture of yeast or barm. Patent dated Jan. 11th, 1849: six months.

William Henry Newton, of Chancery-lane, civil engineer, for a certain improvement or improvements in the construction of wheels. Patent dated January 11th, 1849; six months.—(Communication.)

James Castley, of Harpenden, in the county of Hertford, manufacturing chemist, for improvements in the manufacture of varnishes from resinous substances. Patent dated January 11th, 1849; six months.

Robert Urwin, of Ashford, in the county of Kent, engineer, for certain improvements in steam-engines, which may, in whole or in part, be applicable to pumps and other machines not worked by steam power. Patent dated January 11th, 1849; six months.

Obed Blake, of the Thames Plate Glass Company, residing at 13, Southampton-street. Strand, gentleman, for certain improvements in ventilating; or ventilators for ships, vehicles, houses, or other buildings. Patent dated January 11th, 1849; six months.

Francis Hobler, of Bucklersbury, in the City of London, gentleman, for improvements in the construction of the cylinders or barrels of capstans and windlasses. Patent dated January 11th, 1849; six months.

Michael Loam, of Treskerley, Cornwall, engineer, for improvements in the manufacture of fuzees. Patent dated January 11th, 1849; six months.

Christopher Nickels, of the Albany-road, Surrey, gentleman, for improvements in preparing and manufacturing India rubber (caoutchouc.) Patent dated January 11th, 1849; six months.

William Rowe, of New Wharf, Whitefriars, in the City of London, carpenter and joiner, for certain improvements in the mode of uniting or combining pipes, or lengths of pipes, tubes, or channels, formed of glass, earthenware, or other similar material. Patent dated January 11th, 1849; six months.

William Walker, of Manchester, agent, for certain improvements in machinery or apparatus for cleaning roads or ways, which improvements are also applicable to other similar purposes. Patent dated January 11th, 1849; six months.

Richard Laming, of Clichy la Garonne, near Paris, in the Republic of France, chemist, for improvements in the modes of obtaining or manufacturing sulphur and sulphuric acid. Patent dated January 13th 1849; six months. N.B.—This patent being opposed by caveat, lodged at the Great Seal Patent Office, was not sealed till the 13th January, 1849; but bears date the 4th September, 1848, the day it would have been sealed and dated, had no opposition been entered. (By order of the Lord Chancellor.)

William Betts, of Smithfield Bars, in the City of London, distiller, for a new manufacture of capsules, and of a material to be employed therein, and for other purposes. Patent dated January 13th, 1849; six months.

George Williams, of Tipton, in the county of Stafford, forge manager, for a certain improvement, or certain improvements, in preparing pudding furnaces, used in the manufacture of iron. Patent dated January 13th, 1849; six months.

Conrad Haverkam Greenhowe, of the City of London, civil engineer, for certain improvements in atmospheric railways. Patent dated January 13th, 1849: six months.

Richard Dugdale, of Brompton, in the county of Middlelex, engineer, for improvements in hardening articles composed of iron. Patent dated January 13th, 1849; six months.

Anthony Barberis, of Leicester-square, engineer, for improvements in spinning silk, and in the construction of swifts, and in the arrangement of apparatus for winding silk, and other fibrous substances. Patent dated January 16th, 1849: six months.

Jean Baptiste François Mazeline Aine, of Havre, in the Republic of France, engineer, for improvements in steam sngines, and in the machinery for propelling vessels. Patent dated January 16th, 1849; six months.

William Martin, of St. Pierre les Calais, in the Republic of France, machinist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and also to printing, and other like purposes. Patent dated January 16th, 1849; six months.

Peter Augustine Godefroy, late of Shepton Mallett, Somerset, now of 34, Wilson-street, Finsbury-square, chemical colour manufacturer, for certain improvements in dressing and finishing woven fabrics. Patent dated January 16th, 1849; six months.

Edward Buchler, of the City of London, merchant, for improvements in the manufacture of boots and shoes; also applicable to other fabrics. Patent dated January 16th, 1849; six months.

Carey McLellan, of Larch Mount, in the Liberties of the City of Londonderry, for an improved corn mill. Patent dated January 16, 1849; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Patent dated January 18th, 1849: six months.

John Francis Bottom, of Nottingham Park, Nottingham, lace dresser, and John Dearman Dunnicliff, of Hyson Green, Nottingham, lace manufacturer, for improvements in dressing or getting up fabrics of cotton or silk, and of cotton and silk combined. Patent dated January 18th, 1849; six months.

Francis Alton Calvert, of Manchester, machinist, for certain improvements in machinery for cleaning and preparing cotton, wool, and other fibrovs substances. Patent dated January 18th, 1849; six months.

Thomas Newcomb, of Bermondsey, machinist, for improvements in furnaces. Patent dated January 18th, 1849; six months.

LIST OF SCOTCH PATENTS.

FROM THE 20th NOVEMBER TO THE 13th DECEMBER, 1848.

Alfred Vincent Newton, of the Office of Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for certain improvements in the manufacture of steel.—(Communication.) Six months. Sealed 20th November, 1848.

George Remington, of Warkworth, in the county of Northumberland, civil engineer, for improvements in locomotive-engines, and in marine and stationary-engines. Six Months. Sealed 20th November, 1848.

John Armstrong of Edinburgh, in the county of Mid-Lothian, brass founder, foı improvements in constructing water closets. Six Months. Sealed 23rd November, 1848.

Edward Duncombe Lines, of Chelsea, soda-water manufacturer, and Samuel Luz Freemont, of Love-lane in the city of London, gentlemen, for improvements in the manufacture of colors, oils and varnishes, acids and spirits, and in the manufacture of charcoal, and also of treating vegetable substances for, and in obtaining and treating extractive matters therefrom. Six Months, Sealed 24th November, 1848.

Joseph Lewis, of Salford, in the county of Lancaster, machine maker, and William M'Lardy, of the same place, manager, for certain improvements in machinery or apparatus applicable to the preparation and spinning of cotton, wool, silk, Flax, and other fibrous substances. Six Months. Sealed 24th November, 1848.

John Harris, of No. 4, Richard's Terrace, Albion-street, Rotherhithe, in the county of Surrey, engineer, for a mode, or modes, of founding type, and of casting metal, plaster, and certain other materials. Four Months. Sealed 28th November, 1848.

Alexander Parkes ot Birmingham, in the county of Warwick, chemist, for improvements in the manufacture of metals, and in coating metals. Six Months. Sealed 30th November, 1848.

Alexander Balfour, of Dundee, in the kingdom of Scotland, leather merchant and manufacturer, for improvements in apparatus for cutting metal washers and other articles, and in the construction of buffers. Six months Sealed 4th December, 1848.

Christian Schiele, of Manchester, in the county of Lancaster, mechanician, for certain improvements in the construction of cocks and valves, which improvements are also applicable for reducing the friction of axles, journals, bearings, or other rubbing surfaces of machinery in general. Six Months. Sealed 4th December, 1848.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery, or apparatus, for winding, balling, or spooling thread, yarn, or other fibrous materials. Six Months. Sealed 8th December, 1848.

Alfred Vincent Newton, of the Office of Patents, 66, Chancery-lane, in the county of Middlesex, mechanical draughtsman, for improvements in casting printing types, and in other similar raised surfaces, and also in casting quadrates, and spaces. Communication. Six Months. Sealed 11th December, 1848.

James Henry Staple Wildsmith, of the City-road, experimental chemist, for improvements in the purification of naphtha, (likewise called wood-spirit and hydrated oxyde of methyle,) pyroligneous, acid, and cupion, and certain other products of the destructive distillation of wood, peat, and certain other vegetable matters; and of acetate of lime and shale; and in the purification of coal, tar, and mineral naphtha; likewise spirit being the products of fermentation. Six Months. Sealed 12th December, 1848.

Henry Newson, of Smethwick, near Birmingham, in the county of Stafford for an improvement, or improvements, in trusses. Six Months, Sealed 13th December, 1848.

LIST OF IRISH PATENTS.

GRANTED FROM 22ND NOVEMBER 1848 TO THE 12TH JANUARY, 1849.

Joseph Eugene Asaert, of Lille, in the Republic of France, machinist, for improved means of obtaining motive power. Sealed 22nd November, 1848.

Pierre Frederic Gougy, of Leicester-square, in the county of Middlesex, gentleman, for improvements in apparatus and machinery for raising, lifting, and otherwise moving heavy bodies. Sealed 30th November, 1848.

Alfred Vincent Newton, of the Office for Patents, &c. &c. Chancery-lane, in the county of Middlesex, mechanical draughtsman, for certain improvements in the manufacture of steel. Being a communication. Sealed 2nd December, 1848.

Joseph Lillie, of Manchester, in the county of Lancaster, engineer, for certain machinery or apparatus applicable for purifying and cooling liquids, and for purifying, condensing, and coolinggases. Sealed 5th December,1848.

Hugh Bell, of London, Esq. for certain improvements in aerial machines and machinery in connection with the buoyant power produced by gaseous matter. Sealed 9th December, 1848.

Duncan Mackenzie, of Goodman's-fields, in the county of Middlesex, manufacturer, for certain improvements in jacquard machinery for figuring fabrics and tissues generally, and apparatus for transmission of designs to the said jacquard macninery, parts of which are applicable to playing musical instruments, composing printing types, and other like purposes. Being a communication to him from abroad. Sealed 22nd December, 1848.

Bartholomew Beniowski, of Bow-street, Covent-garden, in the county of Middlesex, major in the late Polish army, for certain improvements in the apparatus for and process of printing. Sealed 3rd January, 1849.

Joseph Simpson, of the City of Manchester, civil engineer, and James Alfred Shipton, of the same place, engineer, for certain improvements in steam engines. Sealed 5th January, 1849.

Charles Green, of Birmingham, in the county of Warwick, patent brass tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of a part or parts of railway wheels. Sealed 5th January, 1849.

Carey McClellan, of Larch Mount, in the Liberties of the City of Londonderry, for an improved corn mill. Sealed 10th January, 1849.

William Edwards Staite, of Lombard-street, in the City of London, gentleman, for certain improvements in lighting, and in the apparatus used therein, parts of which are applicable to other useful purposes. Sealed 12th January, 1849.

William Young, of the firm of Henry Bannerman and Sons, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery or apparatus for winding, balling, or spooling thread, yarn, or other fibrous materials. Sealed 12th January, 1849.

Societies.

INSTITUTION OF CIVIL ENGINEERS,

January 9, 1849.

Joshua Field, Esq., President, in the Chair.

The first meeting of the session is generally devoted to routine business. prefatory of the Annual General Meeting, which immediately succeeds it.

The paper read was "A Description of the improved Forms of Water-Wheels," by Mr. William Fairbairn, M. Inst. C.E. After noticing the opportunity for improvement afforded by the substitution of cast and wrought-iron for timber, in the construction of hydraulic machines, the author pointed out the disadvantages and loss of power attending the principle and the form of the old water-wheels. He quoted Dr. Robinson's "Mechanical Philosophy," for the numerous disadvantages of the old form of bucket, and the difficulties arising from the attempts of the old millwrights to design a shape which should retain the water for a greater length of time in it, and thus give out more power. The chief difficulty was the opposition of the air to the entrance of the water; and numerous contrivances, such as boring holes in the starts, making the spout much narrower than the face of the bucket, &c., were tried; but still the difficulties existed, and induced Mr. Fairbairn to adopt the construction described in the paper, and which he termed "The Ventilating Water-Wheel."

The general object of these modifications was to prevent the condensation of the air, and to permit its escape during the filling of the bucket with water, as also its readmission during the discharge of the water into the lower mill-race.

The paper then described minutely the principles and the construction of the large wheels erected for the Catrine and Deanston Works; for Mr. Brown, of Linwood, near Paisley; for Mr. Duckworth, of Handforth; for Mr. Ainsworth, of Cleator; and for others; and showed, that in all cases, the system had proved eminently successful.

These wheels were all on the suspension principle, with wrought-iron arms radiating from cast-iron centres to the periphery, and so placed that the whole structure was in tension, the motion being communicated from internal toothed wheels, fixed to the shrouding. The various modifications of the forms best adapted for different heights of fall were described; but it will suffice to give that for breast-wheels for high falls, as it appeared the most complete.

These wheels were described to possess many advantages beyond the over-shot, the under-shot, or the common breast wheels, and were best adapted for falls not exceeding eighteen or twenty feet, and where at times there was a considerable depth of back water; and such was the improvement caused by this system, that the wheel at Mr. Ainsworth's mill was frequently plunged from five to six feet in the back water, without its uniform speed being impeded.

The wheel had a close sole, the tail-ends of the buckets were turned up at a distance of two inches from the back of the sole plate, and running parallel with it, terminated within about two inches of the bend of the bucket, immediately above it. The water, in entering the bucket, drove the air out by the aperture into the space behind, and thence into the bucket above, and so on in succession. The converse occurred when the buckets were emptied, as the air was enabled to flow in as fast as the wheel arrived at such a position as to permit the water to escape.

It appeared to be allowed that this system had been very generally successful, and that the results obtained, had approached, very recently, to the stated duty of the Turbine, whose powers had, however, been much exaggerated, and had been allowed, recently, by M. Fourneyron, not to have obtained more than about seventy-two per cent. as a mean duty.

The business of the next meeting, of Tuesday, January 16, was announced to be the reception of the Annual Report, and the Election of the President and Council for the ensuing year.

January 16, 1849.—Joshua Field, Esq., President, in the chair.—The Annual General Meeting of this Institution was held on Tuesday evening, January 16th, when the following gentlemen were elected to form the Council for the ensuing year: —J. Field, president; W. Cubitt, J. M. Rendel, J. Simpson, and R. Stephenson, M.P., vice-presidents; J. F. Bateman, G. P. Bidder, I. K. Brunel, J. Cubitt, T. Fowler, C. H. Gregory, J. Locke, M.P., J. R. MacClean, C. May, and J. Miller, members; and and W. Harding and T. Piper, associates of council.

The Report of the Council was read, and from the statement of its financial position the Society appeared to be governed by men of foresight, who had very properly restricted the ordinary expenditure within prudential limits, whilst the pressure of the times was felt so heavily by all classes. It, however, held out cheering hopes for the future, for, as it observed, "in a country like Great Britain, whose distinguishing characteristic is energetic and indomitable courage in circumstances of great difficulty, it is not probable that any foreign political excitement can long continue to exercise a prejudicial effect; already the horizon is brightening, and a little reflection will demonstrate, that in proportion to the injury arising from the late stagnation, must be the activity on the resumption of the works; and it appears to be acknowledged that the forced economy, which has been practiced during the past year, has caused such a necessity for supplies of working stock, and for the improvement of works, that the engineering profession must be generally benefitted on the return of confidence in financial affairs."

Satisfactory reasons were given for the unusual delay in the publication of the Minutes of Proceedings, and a simple but effective plan was detailed for paying off the debt incurred for the alterations of the House of the Institution.

Telford medals were presented to the Right Honorable the Earl of Lovelace, Messrs. Harrison, Mitchell, and Ransome; Council premiums of books to Messrs. Harrison and Jackson, and Telford premiums of books to Messrs. Redman, Green, and Rankine; the President addressing a few complimentmentary words to each of these gentlemen on presenting the medals and premiums.

Memoirs were read of the Deceased Members:—Messrs. B. Cubitt, T. Hopkins, S. Fowls, members; Lieut.-Colonel Brandreth, P. L. Campbell, F. Carleton, and T. E. Steele, Associates; and J. Pope, graduate. These contained some very interesting biography, and, as a specimen, we may give that of the late Tom Steele, who was a very old Associate of the Institution.

"Mr. Thomas Ennis Steele was the descendant of an ancient and honourable family in the County Clare, where he inherited a beautiful estate, and few men have commenced their career with brighter prospects. He graduated and took his degrees at Trinity College, Dublin, about the year 1817; he then removed to Trinity College, Cambridge, in 1820, and obtained the degree of Master of Arts in that University, on the books of which his name was always retained, and he regularly appeared at the elections. He was an elegant classical scholar, but more particularly directed his attention to mathematics, mechanics, and the application of chemistry to the arts: he also, at one period, devoted much of his time to the study of geology, with the avowed object of preparing himself for travelling in the East; a project which was probably prevented by his entanglement in politics.

His attention being directed to the bad state of the navigation of the river Shannon, he determined to make a personal survey of the bed of the river, which he did in the most complete manner, employing sometimes very original means; such, for instance, as stepping along the line of a reef or shoal, supporting himself with one hand on the stern of a boat, whilst he measured and recorded all the inequalities of the surface, and ascertained the nature of the rock or ground. An account of this survey was published by him; and no greater proof of its utility can be given, than the fact of the greater portion of his suggestions having been followed in the works that have been since executed.

His attention being thus directed to the diving bell, he devised several alterations in its construction and application; particularly a method of lighting the divers, during their submarine labours. All these, with many similar subjects, were published in the current periodicals of the day, and some of them were communicated to this Institution. At a later period, a favorite theme upon which he repeatedly addressed the Institution, was the purchase of the birth-place of Sir Isaac Newton, and its preservation by the scientific world, in same manner that Shakspere's house has since been obtained by the exertions of literary and dramatic men.

He embarked deeply in Irish politics, and became the devoted follower of O'Connell, about the year 1825; but upon that portion of his career, the incumbrance of his fortune, and the melancholy termination of the life of a man who might have been an invaluable member of society, this memoir cannot dwell. His political opponents, however, all acknowledged his honourable feelings, and the entire absence of selfishness in all his actions; and in his last hours he had the gratification of seeing the bitterest among them vieing with each other in their anxiety to serve honest Tom Steele.

He was the most chivalrously minded of men, the most affectionate of friends, and the most devoted of followers, still preserving his independence of mind. He entertained no private resentments which might not instantly be extinguished by the slightest approach to conciliation, even on the part of one who might have deeply injured him; and it may with truth be said, that he never deliberately committed an act by which he thought he should lose a friend, create an enemy, or injure a fellow-creature.

After the decease of his chosen leader, Mr. Steele abandoned politics, and though visibly declining in health and spirits, he stedfastly rejected all offers of assistance from his friends, who desired to cheer the evening of his days, and on the 15th of June, 1848, he expired, a man of fallen fortunes, a crushed spirit, and a broken heart, but universally beloved by all who knew and could estimate the man, apart from the politician."

Votes of thanks were passed unanimously to the President, Vice-Presidents, Members, and Associates of the Council, and to the Secretary; and the President, in returning thanks, gave a memoir of the late George Stephenson, and his connection with the combination of the Fire Tubes and the Blast Pipe in the locomotive, which constituted it the life of the present railway system.

The address was responded to very warmly, and the Meeting adjourned until Tuesday, February 6th, when the following paper was announced to be read—"On the Abbatoirs of Paris,"—By R. B. Grantham, M. Inst. CE..

SOCIETY OF ARTS, ADELPHI,

Jan. 17, 1849.

W. Tooke, Esq. F.R.S. in the Chair.

A. Waterhouse, G. H. Drew, W. Standidge, and J. Gosnell, Esqs. were duly elected as members.

Mr. E. Highton, C.E. read the first part of a paper on Improvements in Electric Telegraphs, and new plans for printing by Electricity.

Perfect as Telegraphs at first sight appeared, observed the author, when Professor Wheatstone applied the discovery of Œrsted to telegraphic purposes, and used the attractive power of soft iron (discovered by Arago) for releasing or guiding the mechanical operations requisite for the purpose of either pointing to or printing letters, still imperfections were found to exist, and those to a very serious extent, so much so, indeed, as to render in practice, many of the proposed plans perfectly useless.

Previous to pointing out the imperfections alluded to, Mr. Highton made a few remarks relative to the action of Electricity and Magnetism generally. He then proceeded with the object of the paper, and considered the subject under the following heads, viz. First, the Instruments; Second, the Conducting Wires; Third, the Batteries; and Fourth, the Action of Atmospheric Electricity, Lightning, the Aurora Borealis, and Electrical Fogs.

The first Instrument he noticed was the Bell. The ringing of a bell at a distant point, under the latest improvements of Messrs. Wheatstone and Cooke, is effected by means of the attractive power developed in masses of soft iron. The latest improvement consists in removing a detent from the wheels of a piece of clock-work by the momentum obtained from a falling weight; the weight falling by the force of gravity on the catch of the wheel-work of the bell when the detent is withdrawn by the attractive power of magnetism developed in an electro-magnet of soft iron.

The method employed by the Messrs. Highton differs from the foregoing as regards the mechanism, in the same manner that a watch differs from a clock, a watch being capable of continuing its action in any position. The plan consists in making a spring act by a connecting rod on the circumference of a wheel: attached to this wheel is the catch detained by the electro-magnet armature.

The removal of the armature detent is effected by electro-magnetism developed in the metal nickel. The alarum may also be rung by magneto-electricity by merely removing the armature from a magnet.

Messrs. Highton propose using the metal nickel as an electro-magnet in all step-by-step motions, owing to this metal producing little or no residual magnetism.

Having thus alluded to the Bell, the author next proceeded to describe the first and most simple form of Telegraphs, and as an instance of the class described the Needle Instrument of Messrs. Wheatstone and Cooke. The signals with this instrument are given by the deflection of one or more magnetic needles.

In the arrangement of the coil and needle of Wheatstone and Cooke, the wire of the coil passes in every convolution twice over the middle or dead part of the magnet. In Messrs. Highton's plan a horse-shoe magnet is used instead of a needle, and the wire is placed near the poles only. By this arrangement the resistance offered to the current of electricity in having to pass over the dead part of the magnet is entirely got rid of, and the centre of oscillation and percussion brought much nearer to the centres of gravity and motion, and hence less electric power is required, and the oscillation of the needle at the same time removed.

The next class of instruments alluded to was that in which a step-by-step motion is employed. The inconvenience attendant on the use of these forms of telegraphs is that, when one error is made in the transmission of a sentence, subsequent errors are entailed throughout the message, until, by preconcerted signals, the instruments are reset by all the operators in the circuit. Messrs. Highton's improvements consist in the application of an additional electro-magnet, by means of which the step-by-step movement may at any instant be thrown out of gear, and the hand, pointer, or disc progress at one bound to zero or starting-point.

This arrangement doubles the speed of transmitting information, and also enables any number of words or sentences to be added to the end of the alphabet, without increasing the time requisite for sending a message by letters only, and at the same time, gives absolute security to the working of this class of instruments, and prevents any error in the transmission entailing subsequent errors in the message.

The third class of telegraphs alluded to were those which instantly expose to view any desired letter when a corresponding key is touched.

Previous plans require 26 wires to effect this; in Messrs. Highton's plan, *three wires only* are requisite. The letters are shown by the single or combined motion of *three screens,* no weights or wheels, or similar description of mechanism is employed, but each screen can, by motion to right or left, be made to assume any one of three positions, and thus by the combination of three screens, any one of twenty-seven positions can be produced.

Mr. Highton then proceeded to describe the application of this property to Printing Telegraphs, and showed how, with three wires only, any one of twenty-six letters could be printed instantly at different stations, and that as rapidly as the corresponding keys could be played on. The arrangement of the mechanism in these Printing Telegraphs is such, that no error or inaction of any of the parts of the instruments, can entail subsequent errors in the message.

Mr. Highton described six different kinds of Printing Telegraphs, suited respectively to one, two, or three-line wires, and combining several of the above improvements.

This concluded the first portion of the paper; the second part is to be read on the 7th of February.

The thanks of the meeting were presented to Mr. Highton.

INSTITUTE OF CIVIL ENGINEERS OF IRELAND.

The fourth general Meeting of the Institution, for the present Session, was held at the Custom-House, Dublin, on Tuesday evening, January 9th, Lieut.-Colonel Harry D. Jones, R.E., in the chair.

The Secretary, Mr. Clarendon, read the minutes of the last general meeting, which were confirmed.

Mr. Ottley begged to present to the Institution a model of a sling scoop, which had been used by him in the excavations of the Portna shoals, in the Lough Neagh Drainage District. The model was constructed to a scale of four inches to a foot, and Mr. Ottley fully explained the mode of working, the lift, and other useful details. He also wished to present a model of a rake for removing the butts of dams, used successfully by him, and further illustrated the subject by reference to a drawing prepared for the purpose.

The thanks of the Institution were voted to Mr. Ottley for his valuable donations.

An interesting paper was then read by Mr. William Frazer, giving an account of some experiments made by him on the strength of timber lattice beams. The paper was of considerable length, and was illustrated by several drawings, showing the disposition of the timber in the lattice work, the mode of applying the weight used in making the beams; and the mechanical contrivances used to keep them from buckling. To explain the construction more fully, there were also exhibited portions of three of the models experimented on.

It appeared that the writer was lead to make these experiments, from having to erect a bridge, 50 feet in span, across the river Nore, at a place where a stone bridge would have been too expensive; and where, owing to the influence of local circumstances, a central pier would have been incompatible with safety. The lattice principle was, therefore, adopted; but this sort of bridge being so new in the country, and mathematical science giving such little aid in investigating the law of its stability, he was induced to make these model experiments on the comparative strength of various arrangements of the lattice bars, to satisfy himself as to the strength of the bridge he proposed erecting.

There were three series of experiments, each consisting of three models. In the first and second series, the arrangement of the parts was the same, except that in the first series the string or sealing pieces were single, and between the lattice bars; whilst, in the second series, they were double, and placed on the outside of the lattice bars. In these two series there were string pieces at top and bottom, and one in the middle.

In the third series the construction differed from that of the first and second, in having the lattice bars closer together, and a greater number of diamonds to the depth of the beam. In this, also, there were but two double string pieces—the middle one having been dispensed with.

The weights were suspended from the centre of each beam, which was thus tested under the most disadvantageous circumstances.

The details of each experiment were carefully tabulated, showing the incremental and total weight, with the corresponding deflection of the beam until it broke.

The result showed the advantages of the arrangement adopted in the third series over that of the others—as, with a quantity of timber, somewhat greater than that in the first series, but less than that in the second, its breaking weight was much greater than that of either, whilst its comparatively small extent of deflection, under an equal weight, showed its superior rigidity.

After the reading of this paper there was a good deal of desultory discussion as to the various modes of preventing the beams from buckling, different arrangements of the lattice bars, the advantages of a central string piece, and the best position of the roadway.

Mr. Mallett hoped this paper would be laid before the Council, as he conceived it was one of the most important which had yet been brought before them. He conceived there was much irrelevant matter introduced into the discussion—that Mr. Frazer's object in making these experiments, was not *how to avoid buckling,* but to determine, with regard to the law of stability, certain empirical numbers, which would assist theory in a matter so intricate. Mr. Mallett then drew attention to some points which, he conceived, these experiments illustrated, such as the inutility of a central string price, the rigidity obtained by increasing the number of crossings of the bars in the depth of the beam, &c. He also pointed out the difference between the structure of these models and that of the lattice bridges as originally erected by Towne, in America. He hoped Mr. Frazer would continue the investigation, and communicate the results to the Institution, as he felt much interest in the subject, being the contractor for what he believed would be the largest timber lattice bridge in the United kingdom, that across the river Nore, in the line of the Waterford and Kilkenny Railway.

Mr. Mulvany said that he had seen the bridge erected by Mr. Frazer across the Nore, and it looked so light as to give the idea of insecurity; which was, however, quite removed by going upon it, and feeling its great steadiness.

Mr. Mac Mahon conceived that, notwithstanding the advantages of wood and iron for constructions of the kind, under peculiar circumstances, stone was the cheapest and best material that could be used. Timber could not be expected to last for more than fifteen or twenty years at the farthest, and then there would be incurred the entire cost of reconstruction.

Mr. Mulvany thought it very natural that Mr. MacMahon should be partial to stone constructions, considering that he had been so successful in them; but he was of opinion, that in Ireland there was a great mistake made in incurring such expense in the primary erection of its public works. He conceived it would be more prudent to erect, in the first instance, works of a mere temporory description, which could be replaced by a more permanent class, as the profits arising from such works enabled the alterations to be made.

In the case before them, a bridge 50 feet in span was built for about 130*l.*, where a stone bridge would have cost, perhaps, 400*l.*, He proposed the thanks of the Institution to Mr. Frazer for the models which he had presented to them, and he trusted, whatever other experiments he might make, he would give the Institution the benefit of them.

Discovery of the Ruins of a City in Asia Minor.—The *Constantinople Journal* gives some details of a discovery made by Dr. Brunner, an agent of the Turkish Government, who was employed in taking a census:—While occupied in exploring the excavation of Bosouk, on the confines of Pontus, Cappadocia and Galatia, a villager offered to show him objects far more interesting. The Doctor, having followed his guide round the mountain, found himself in the presence of the ruins of a considerable town. These ruins are situated to the south-east of the village of Yunkeiü and to the north of the village of Tschépué, distant half a league from each other. The site of the town is half a league in length. It contains seven temples with cupolas and 218 houses; some in good preservation, others

half choked up with their own ruins and with vast fragments of rock detached from the overhanging mountain. The houses have compartments of three, four and six chambers, and the temples are also flanked with chambers. The largest of these edifices is twenty feet long by twenty-eight wide. As near as the Doctor could conjecture the height of some of the temples is from 20 to 30 feet. The natives call them " Monuments of the Infidels." The Doctor fails to recognize this ruined city, as being before described, but Mr. W. J. Hamilton, writing to the *Athenæum*, says: " Not far from this locality, viz. on the northen slope of Hassan Dagh, a remarkable conical volcanic mountain, at least 8000 ft. high, and until lately, omitted from all our maps of Asia Minor. I was fortunate enough, in the year 1837, to discover the remains of an ancient city of very remarkable character, and perfectly unique in the style and preservation of its buildings, combining a mixture of old Hellenic construction with the more modern structure of Greek or Byzantine churches. These ruins are described in vol. 2 of my researches in Asia Minor, and no doubt remains on my mind that they are the same as those supposed to have been discovered by Dr. Brunner.—It will be seen that I have there given the reasons for concluding that these ruins mark the site of the ancient Nazianzus, situated at the foot of Mount Athar."

THE UNICORN AT LAST.—We see from the *Athenæum*, that Baron Von Müller reports the existence in Africa of an animal of the size of a small donkey, with a long horn on its forehead, which it usually hangs down, but which it immediately erects on seeing an enemy. This animal, called the " A'nasa," was clearly distinguished by one of his informers, from the rhinosceros. The interior of Africa still presents a wide unexplored field for the adventurous traveller. While on this subject, we may report on the authority of the *West Briton*, that Mr. Burnard, a Cornish artist has been commissioned to execute a statue of Richard Lander, the African traveller, who was a native of Truro. The statue will be placed on the Lander column at the top of Lemon St., Truro; the height is to be about eight feet, and the material, stone, either Portland or magnesian Limestone.

Building Arts.

BATHS AND WASH-HOUSES.

We present our readers this month with the Plans of the Baths and Wash-houses, in Paul-street, Liverpool, for which we are indebted to the architect, Mr. Franklin; and also with a plan of the Baths, Rue Racine, at Paris.

The Baths and Wash-houses in Paul-street, Liverpool, consist of a brick building, with stone dressings, in the Elizabethan style of architecture. The immense benefit accruing to large populations from such useful and salubrious institutions, renders comment unnecessary, for every well-wisher of humanity must anxiously desire the day when such buildings will form a feature, we had almost said, in every street.

Previous to the erection of the building in Paul-street, the only other building of the kind was in Frederick-street, both being built at the expense of the Corporation on their land. The building in Frederick-street was opened in 1842; this building, which was rather of an experimental nature, is less extensive and complete than the one in Paul-street. The principal building is of plain brick, and two stories high. To the front is the Superintendent's house, and at the back are rooms containing 18 private baths and one vapour bath, and these are divided into first, second, and third class, at different prices. The room on the first story, containing eight third class baths, is 24 feet long, by 16 feet wide. On each side of a passage running down the middle, are four small rooms, separated by wooden partitions, 5 feet 9 inches by 5 feet; in each of these is a bath, to which hot and cold water are conveyed by means of pipes. In the first and second class baths, the bathers supply themselves with water, but in the third class the baths are filled by the superintendent. The following are the dimensions of the baths :—

Length at top . . .	5′	3″
„ bottom . .	4	0
Breadth of head at top .	2	0
„ „ bottom	1	9
Breadth of foot at top .	1	4
„ „ bottom	1	1
Depth of bath . .	1	11

Each individual requires 45 gallons of water for a bath. The baths are lined with smooth slates, and a portion are fitted as shower baths.

The vapour bath is of zinc, and is placed in a room supplied with a sofa and blankets.

The wash-house is in the back cellar, and contains twenty-one tubs and two boilers and a drying stove. The dimensions of the tubs are as follow: 22 inches long, by 24 wide at top; 13 inches at bottom, and 11 deep. Hot and cold water are conveyed to them by pipes, and are let on by keys. The drying room contains five iron sliding horses, 14 feet long, and 7 feet 4 high, divided in the middle by a rod to keep the clothes of two individuals separate; but the size of this drying room is found quite insufficient to dry the large quantity of clothes that are washed.

The clothes of persons suffering from infectious disorders are washed in a small detached building; each set of clothes is received into a tub containing a solution of chloride of lime, and they are washed and dried separately.

The water supply is contained in three iron tanks, one for cold water, holding 7000 gallons, and two for hot water, holding 1400 gallons each; these are filled daily, but this supply is found inadequate to the requirements, particularly in summer. The water is heated by a furnace in a detached building under the tanks, and the vapour bath and the drying stove are heated by steam conveyed by iron pipes. The cost of this establishment was as follows:—

Building contract . . .	£1420
Boilers and tanks (contract) .	487
Fittings and sundries . .	689
Gas fittings and furniture . .	50
	£2646

The following items were in the current annual expenditure:—

Water	£52	12	0
Coals	52	12	0
Fireman's wages	54	12	0
Superintendent and Matron, with house-rent, taxes, coals, water, and gas . .	90	0	0
Allowance for a female servant . .	30	0	0

Clothes belonging to the poor suffering from infectious disorders, will always require to be washed immediately; and when received, they should instantly be put in a solution of chloride of lime; great expedition will also be required in drying them, that they may be returned as speedily as possible. This department of the wash-houses must, therefore, be always adequate and well fitted up, and arrangements should be made to meet the increase of soiled linen in times when infectious diseases are raging, and when the poor suffer most from want of clean clothes.

The building in Paul-street, of which we have given the plans, covers about 1620 yards of ground, and the cost complete was estimated at about 6500*l*. The central portion of the building is two stories high, but, as will be seen by the plans, the portion containing the plunge baths consists of one story only, and the wash-houses at the back are also only one story high.

In fig. I, *a* is the superintendent's room, so centrally placed and constructed as to command a view of *e*, the entrance for males, of *f*, the entrance for females, and also of the respective waiting rooms for each sex, *g* and *h*.

On each side of the passage, *c*, are four separate baths for males, with one shower bath; *b*, *b*, are private baths with shower baths; *d* is a vapour bath, and and *p* a water-closet. On the female side, the same letters correspond to similar conveniences.

The plunge bath for males, *i*, is 27 feet by 17 feet 8 inches, with 4 feet 9 inches depth at one end, decreasing to 3 feet 3 inches at the other. Wooden steps are placed in the water, opposite each of the dressing rooms which surround the plunge bath, and a convenient passage surrounds the whole.

At the rear of the building are six washing houses, and a drying stove, 20 feet by 18 feet 6 inches; these are marked *m*, *m*, *m*, &c. The drying stove is heated by a furnace and cast iron flues, and it is provided with sliding horses for drying the clothes.

The wash-houses are one story in height, lighted by sky-lights, with air tanks in the floor, and are ventilated at the roof, as shown at *m*, in fig. II.; in each wash-house are ten washing tubs and a boiler.

At *l*, is the wash-house for washing infected clothes, with seven tubs and a boiler; this building is 15 feet by 12, one story high, and lighted and ventilated as the general wash-houses.

On the one pair story, fig. II. are a committee room, *e*, and the superintendent's room, *a*; the rooms marked *n*, on both floors belong to the superintendent.

On the one pair story, are eight separate baths, with two shower baths, by the sides of the passage *c*, two private baths, *b*, *b*, and one vapour bath, and a water closet; for females there are six separate baths with a shower bath, a private bath with a shower bath, and a water closet.

Altogether, therefore, there are, two plunge baths, thirty-four separate baths, with twelve shower baths, and four vapour baths; *q*, *q*, are for ashes.

On the floor of the apparatus house, K, are two wrought iron cylindrical boilers, 4 feet 6 inches in diameter, and 14 feet long; the furnace is in front of the boilers; the flame passes first under the bottom of the boiler to the back, then returns through a flue passing through the centre of the boiler to the front; here it divides, passes down each side of the boiler to the back, where it unites in one flue and passes into the chimney. The flame and hot gases thus bear on a large surface of the boilers, and parting with their heat in their progress, enter the chimney at a very low temperature.

An apparatus for consuming the smoke is attached to each furnace, of which, the principle is the admission of hot air at the bridge, where the flame and smoke first bear on the boiler.

In the floor of each ash-pit is a grating, which parts with the mere ashes, allowing them to pass into a vault, from whence they may be carted away, whilst the cinders are saved and used again in the furnace.

The cistern for hot water, 18 × 14 × 5, is of strong wrought iron, and well stayed interiorly; it is fixed at a height of 20 feet directly over the boilers; the top is rivetted close down; there is a man hole, and also a safety pipe open to the atmosphere.

The general tank forms the roof of the apparatus house; it is of wrought iron and well stayed.

The general tank, having a water guage to show the height of the water, is supplied by a main from the public works; from this tank the water flows to the hot water cistern, through a 4 inch pipe, having a valve at top acted upon by a stone float, which keeps the water in the cistern at a uniform level, which level is ascertained by a water guage.

A six inch pipe from the bottom of the hot water cistern descends into the boilers through the top, near to one end, and discharges the water near the bottom, at the end opposite to the entrance pipe, and from the top of each boiler is a six inch ascending pipe, leading to the hot cistern by a curve two feet above the bottom of the cistern.

For washing the infected clothes, hot and cold water are conveyed directly from the cistern and tank by means of pipes.

Four inch pipes from the cistern and tank lead to the north east corners of the large plunge bath, where they branch off to the washing houses; along the whole range of the wash-houses are three inch pipes, from which two inch branches lead the hot and cold water to each set of tubs; and each tub is supplied with taps for hot and cold water, and with plugs for letting off the waste water.

The four inch pipes are continued from the plunge bath, and by means of two and a half inch pipes the water is conveyed to the baths on the ground floor, and by two inch pipes to the baths on the one pair story.

The furnace for heating the drying room is formed under a fire brick arch, from the back of which, a 15 inch cast iron pipe leads round the basement under the clothes horses, and then enters the chimney above the surface.

Fig. III. is the ground plan of the Baths in the Rue Racine, at Paris; *a*, is the entrance hall, and *b*, a common waiting room; *c* is a waiting room leading to the female side *d*, where there are altogether thirteen separate baths and two more *e*, in the garden; *f*, is the waiting room leading to the male side, where there are altogether seventeen bath rooms; *g*, *g*, are water tanks, and *h*, *h*, boilers. The baths properly so called are in a building only one story high, and lighted from the gardens in the centre or at the back.

DRAINAGE.

The salubrity of a building in a very great degree depends on the absence of vapors from the site on which it stands; this is universally acknowledged, and yet it is surprising how often we see a handsome structure in a wet situation, with wainscoat, paint, paper, and the very walls disfigured and decaying; and all that is said or done, is just to make the passing observation "yes, it is very damp," whilst fevers, agues, rheumatics, and other evils to which flesh is heir, work on their havoc on young and old; but even if we put these matters aside from our thoughts, and few will do it who have any reflection to help them, still it must be remembered that the very foundations of a building are perilled by such a state of things; aye, as surely as though legions of rats were undermining them. The poor especially suffer from this neglect of one of the elements of health; how many a cottage may be marked as though doomed to be a house of mourning! and the affluent forget, until it too late, that contagious diseases will sometimes stretch out their wings, and flap them over their luxurious homes, if but to remind them that they are mortal. And this is independent of land lying waste, now that we should not spare a foot. A few hints on the subject of the removal of such inconsiderate and ill-mannered visitants, will show that in very many cases it is neither difficult nor expensive.

Marshy or boggy land is produced by one of two causes; the first is stagnant rain water, lying on an impervious clay soil which is so flat that the water does not flow off, and perhaps surrounded by similar impervious land at a higher level, thus forming a kind of pond. If we can find any outlet, that is, a lower level at any convenient point, there will be no difficulty in cutting a main drain to it, being very careful that no part of this main drain is cut deeper than the outlet; and to this main drain we may make as many side cuts as necessary; the proper line of direction for the main drain will be first, the straightest, and therefore the shortest, line to the outlet; but we should also follow up any line of extreme wetness, and therefore of lower levels in the land which will be shown by a coarse rushy vegetation in such parts, provided always that such be not below the level of the outlet; of course the lowest part of the ground, if any, will be the situation of the main drain. As regards the side cuts, their number must of course be according to the extent of land we have to drain, and as regards their depth, they must be cut through the soil formed by decayed vegetation a few inches into the retentive clay; this requires attention, inasmuch that such soil is porous and spongy, and if any remained in a cut or drain, it would suck in the water, and render the work done inefficient. It may however happen that we cannot find any such outlet, that is within reach of suitable means; we must then try for what other means may be left by nature, and avail ourselves of any of these.

It is not very general for a flat extent of land to have a subjacent stratum of clay of great depth; three, four, or five feet is a common depth, and from this to ten feet, of which, however, we may not have an instance of one in ten; under the clay we shall generally find gravel, sand, loose rock, or some other porous stratum which will absorb water, and acting like a large drain, pass it off. If, therefore, through the impervious clay we excavate a pit or well of three or four feet diameter into the porous substratum, we at once obtain a conduit for the surface water or stagnant rain; this pit or well must be made in the lowest part of the ground, a main drain led to it from through the field to be drained, and side cuts made to lead into this drain. When the first drainage has been thoroughly effected, the pit and drains may be filled with large and small stones, and coarse sand may be very beneficially added, or the pit may be left open and railed round to prevent accidents. Another method of effecting the same drainage by the same principle, though in a different way, is that of bore holes from the *surface of the impervious* earth, to the porous substratum below; these bore holes of from two and a half to three and a half inches diameter, are bored along the bottom of the drain, which may be four or five feet deep, at a distance of about forty or fifty yards at first, and they may be made more numerous afterwards if those already made are not found sufficient to effect the object in view. Over the bore a good sized stone should be laid to prevent any rubbish from filling it up, and the drain should then be filled with broken stones covered with sods, grass downwards, to within a foot and a half of the surface; not to interfere with cultivation. One of the above means may always be effectually employed, except in the following case.

The reader will be aware that substrata of sand and rock, more particularly the former, are very often subterraneous reservoirs of water, and

if at any side there be porous high lands this will pretty surely be the case; and yet the water from this reservoir may not make its appearance at the surface, from being contained by the overlying retentive clay. If in order to let off surface water we bore at the bottom of the drains, the bore holes will be nothing more or less than so many taps on the subterraneous water, so that instead of draining the land, on which we are operating, of the injurious surface water, we should inundate with spring water. It follows, that before we determine and set to work on a system of drains and bore holes, we must ascertain by boring in the lowest part whether our porous substrata contain any large quantity of water, and whether in the event of such strata being tapped, the water will overflow. The annexed cut will explain our meaning. By means of banks, pits, quarries, &c., we may often ascertain, after some consideration, the dip and levels of the substrata, and then be enabled to decide on what further means we should employ.

In the cut, the sand crops out at A, which is higher than the lowest part of the land to be drained; B B is an impervious stratum; the bore hole therefore will but be a channel of conveyance for the water from the sand, if it contain springs. It will now be necessary to find the lowest level of A, and then to cut a drain in order to let off the water from the sand, and then, but not until then, we may lay out our drains and fix our bores. This is one instance of the care required before we determine on a system of drainage, as well as of the investigation we should make before we give up our attempts.

The principle just laid down is in many places well understood and practised, and has, therefore, nothing of a new theory about it; judgment only is required in examining the strata, and in applying the principle according to circumstances; and whatever we may be doing, a proper application of a principle is an indispensable essential of success.

(To be continued.)

A FEW SUGGESTIONS ON IMPROVEMENTS IN MANUFACTORIES FOR DRAINING TILES.

The very extensive application of draining tiles at the present time both to the drainage of vast tracts of land and the sewage of cities and large towns, has rendered the subject of their manufacture one of considerable interest, more particularly when the fact is known, that perhaps, more than one hundred enterprising land proprietors have already commenced the manufacture of draining pipe tiles on their own estates, in Great Britain and Ireland.

In many of these private manufactories which are merely erected for temporary use and home manufacture, the system has been adopted of sending for a machine-man and tile-burner from some works in operation elsewhere and leaving, all the details to their management; and perhaps this may be the most judicious course, where a landed proprietor or his agent has not much spare time to devote to the working of the concern, and does not care much about expense.

Under such circumstances, the yard and buildings are generally laid out with very little regard to the future working of it, either as to storage, economy of materials, or saving of coal, labour, or carriage.

No doubt an excellent investment of capital would be made by establishing tile works on economical principles. where clay, coal, and canals were in close juxtaposition, and that in this way a saving of nearly one third would be effected as compared to their present manufacture.

The annexed plan on a scale of 20 feet to an inch, is adapted for a tilery which would turn out about 30,000 tiles weekly. The enclosure about half an acre of land in a space 132feet in breadth, by 165 in length.

In the centre at the upper end is placed the pug-mill *a*, and on each side are two sheds for clay *b* and *c*, each about sixteen feet by twelve, capable of holding say forty cubic yards of clay to six feet in height, thus serving as an accurate measure for the quantity of clay brought into the yard, and of course, the men will be engaged in filling one shed with clay while the other is being manufactured and put through the pug-mill. On each side of the sheds is shewn a gateway for bringing in the clay without interfering with the lower part of the yard.

In the centre of the opposite side of the yard are placed two kilns *o* and *p*, each twelve feet square in the clear, a description of which will be given in a future article.

From the door of each of these kilns is shewn a railway running through each side of the drying shed *f g h i*, curving round by the turntables at the bottom, and the pug-mill, at the top of the yard, on each side of the depots for tiles *x x*.

In the carriage of more than an hundred tons per week which would be entailed by the manufacture of 20,000 tiles, on a light description of railway with waggons holding about one ton each, a vast saving in labour will be effected, and also in avoiding breakage when stowing the tiles or emptying the shelves. With such waggons two boys would do all the haulage without any other assistance. The machine also being mounted on flanged wheels, is made to run on the same line followed by a tender with clay ready tempered and screened.

The two depots *x x* are each about 120 feet by 25 feet, capable of holding upwards of 400,000 tiles on each side stacked ten tiles in height, leaving 25 feet of an open space to admit air into the shelves of the drying shed, also leaving a road to draw away, and load the tiles through the gateways shown on each side of the kilns. In the corners opposite the kilns are two coal sheds *n* and *r* 16 × 12, and at the corners opposite the clay sheds are shewn two other buildings of the same size for an office and a toolhouse *l* and *m*, the whole yard to be surrounded by a wall five feet in height with an open drain outside five feet in width at top, by two feet six inches in depth.

The drying shed should be placed as near the turntable as the curve of the railway will allow. In this building we have to provide for filling the shelves from the machine as the pipes are being made, drying them as effectually as possible by a free circulation of air, rolling them into shape, and when dry removing them to the kilns to be burnt. All this may be very easy in a shed capable of turning out 30,000 pipes per week, when only 20,000 are actually made, in which case the machine and the shelves will be at times idle, but to turn out the full quantity without causing confusion requires some little management.

In some manufactories the drying sheds are built very narrow so as merely to leave room for the boys to roll the pipes and not to admit the machine into the shed, but instead of this to manufacture the clay into pipes in a separate building and have them carried in trays and laid on the shelves by boys; this causes much running to and fro, and in order to protect the shelves from the weather it is necessary to bring down the roof on each side within three feet of the ground, which prevents a proper exposure of the shelves to the external air. The same objection applies to a wider shed in which all the operations are carried on in the exterior, and the building becomes all roof with much useless empty space. In a shed of this description eighteen feet in the clear between the shelves, the distance between the projecting eaves from outside to outside, cannot be less than thirty feet. Besides all this, the machine-work, rolling, and emptying the shelves all going on inside together causes confusion and delay.

In the annexed plan an attempt has been made to neutralize most of these objections.

The railway is made to serve three purposes. To bring down the machine to the pug-mill, where the clay is tempered, pugged and screened and then along the shelves as the manufacture proceeds, so as to avoid all carriage of pipes in a green state; next to carry the pipes when dry from the shelves to the kiln, and lastly to carry the pipes when burnt to the depots *x x* along each side of the yard.

The drying shed *f g h i* is 75 feet in length by 23 feet in width, open all round the outside to a height of seven feet, the roof being supported by wooden pillars. The centre compartment *d* is five feet in width between the shelves, which are shewn etched in on each side, they are two feet

wide, holding a double row of pipes along each; and as there are ten rows of shelves, there is room for forty rows, each 75 feet in length.

The outside compartments are each seven feet wide in the clear, along the centre of which the railway is laid, and then two lines of railway are connected with each other by turntables with passing places opposite the centre of each kiln.

It is necessary in the first place, that as much clay should be prepared for the machine as will fill one of the four rows of shelves with pipes from end to end, and being screened by the machine as it comes from the pug-mill it can be brought down after it in a railway waggon. The machine then is moved along from *g* to *h* turning out pipes at both ends till the outside rows of that shelf are completely filled.

Then while the same operation is going on from *i* to *f*, the boys inside the centre shed *d* are rolling the pipes first made and removing them to the inner side of the shelves.

The exterior rows of shelves from *g* to *h*, being now empty, the machine comes back again to fill them, while the boys roll and remove to the interior the pipes from the side *i f*, and while the machine is making the fourth row, they are rolling the third row, and so the work proceeds.

While the machine is screening clay to commence filling the shed a second time, the shelf from *g* to *h* is emptied and taken to the kiln so that in moderately drying weather the machine, the rollers, emptying &c., all go on in succession without ever interfering with each other.

In damp or frosty weather the drying can be accelerated by hot-air pipes from the flues of the kilns which can be laid along the floor of the central shed *d* between the drying shelves.

The curved line of railway at each end of the yard with the two turntables opposite the kilns opens out a perfect communication at any time from the kiln to the store yards without interfering with the work going on in the shed. It may be as well to remark that the plan is merely adapted to a manufactory of circular pipe tiles with collars for draining purposes on extensive landed estates.

Fig. 3 shews the end elevation of the common kind of drying shed, sixteen feet wide in the clear, with projecting roof to keep off the rain from the pipes when drying. In unsheltered situations subject to violent winds, such a shed is very liable to be blown down in stormy weather, particularly in Ireland where thousands of acres of wood are sometimes levelled to the ground in a single night. It also contains much vacant and useless space in the roof.

Fig. 2 shews the end elevation of proposed shed in which it will be seen the shelves are much more effectually protected from the rain and more open to the action of the air.

Fig. 4 is an enlarged plan shewing the shelves on a scale of three feet to an inch. The timber is sawn in six feet lengths to a scantling of 1 inch by 1½ net, so as to leave an open space of 2 inches in the clear between them, and provided the timber is well seasoned, they can be simply laid down in grooves cut exactly to fit them without any nails as the pipes when laid on will keep them in their berths, and they are easily taken out to be repaired. As there are to be ten shelves in a height of seven feet, the distance between each shelf will be about seven inches in the clear, which is sufficient for pipes of four inches in diameter; those of a larger size, if any are required, will not dry in an horizontal position and keep their shape, but must be set upright on their ends.

Senlin.

Bristol,
January, 1849.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(Continued from p. 9.)

Templates and Sundries.

Ground Floor.—Generally set a template of tooled *York*, 12 in. by 9 by 3 under all the iron shoes. Fix other templates as follows, of tooled *York* cut to sizes given, and large mortices cut for iron beams. Four in south-west angle offices 24 in. by 18 by 4, and one for pillar 22 in. by 22 by 6. Fix in north-west angle offices two templates, 24 in. by 18 by 4, and two bases for pillars, 22 in. by 22 by 6: 2½ in. tooled *York* coverings to piers built to carry slate cisterns to be fixed in the basement story. Fix four templates under iron beams in ceiling of retiring-room adjoining Lloyd's staircase on the ground story, 24 in. by 18 by 5.

Mezzanine Story.—Fix six *York* templates to floor in south-west angle, 24 in. by 18 by 4, and two similar in floor of north-west angle, and four similar under bearers of floor of retiring room adjoining to Lloyd's staircase. Generally, provide and fix in this and other floors 153 *York* templates, 9 in. by 9 by 3, to receive ends of trimmers or other timbers, in chimney-breasts, or other places which may require them.

One-pair Floor.—The main and other iron beams over the Ambulatory will bear on *York* bond-courses to be hereafter described. Fix to floor in offices in south-west angle, five templates, 24 in. by 18 by 4, and also lay 6 in. tooled *York* on iron beams under chimney-breast, 9 ft. 7 by 1 ft. 11. Fix on walls and iron bearers over the staircase 7-inch tooled *York* landings, 12 ft. 6 by 6 ft. 9. Fix templates, 24 in. by 14 by 4, under ends of iron beams which steps across openings in staircase wall.

Roofs and Flats.—Provide 60 ft. superficial 4-inch *York* templates, to be laid where the architect shall direct, in walls for plates of roof of subscription-room, captains' room and lobby, and perforate ten holes in it for flues; allow, in addition, 20 ft. superficial of similar templates for the walls round roof of court-room of the Royal-Exchange Assurance, and four perforations in it for flues. Allow for two *York* templates, 36 in. by 24 by 5, for iron bearer under roof of the London Assurance. Fix two *York* templates, 48 in. by 24 by 5, for girder under flat and roof in north-west angle. Fix two templates, 36 in. by 18 by 5, under iron beam over one side of Lloyd's reading-room, and two similar templates for ends of beam under roof at east end. Fix three templates, averaging 4 ft. superficial, of 5-inch *York*, on walls round bar and captains' room, and allow for three holes in flues cut therein. Fix six *York* templates, 36 in. by 18 by 5, for iron beams of flat over Lloyd's staircase. Six similar templates under ends of iron beams over captains' room. Fix two templates, 30 in. by 18 by 5, under beam at east end of roof of the London-Assurance office.

Great Span-roof West End: six *York* templates, 48 in. by 27 by 9; 22 other templates averaging 42 ft. and 27 in. by 6, and allow for four perforations for *York* in them.

Sundries connected with Water-closets.

Fix 2½ in. tooled *York* covering on the piers under the slate cisterns on basement. Fix 4 in. *York* covers 21 in. square over one hundred and thirty-five curved shoots for traps and pipes into drains, with a pipe-hole in each, cut and rebated all round, 2 in. wide, for flange of pipe.

Fix templates, 18 in. by 14 by 5, for the ribs forming the quadrant brackets under ceiling of Ambulatory. Fix four templates, 24 in. by 18 by 5, under iron beams which carry arches to ceiling over entrance to Ambulatory from east area.

All the above bedded in Roman cement, cut to fit with caulking-holes cut in them.

The contractor to provide and bed 13,000 feet superficial 3-in. hard tooled *York*, 4000 feet superficial of 4-in. ditto, and 6000 feet superficial of 5-in. ditto in bond-courses and coverings, varying from 24 to 36 in. in width, and from 30 to 60 inches in length; the edges to be cut to fit, and the same to be secured with 3018 cast iron ten-inch cramps and cement, and to have 300 large caulkings cut in the same for iron beams. The bond-courses to be bedded in Roman cement.

The contractor to find and bed, beyond what is shown and directed, 204 *York* templates, 9 in. by 9 by 3, and 76 ditto, 13 in. by 16 by 5, and long mortices cut in 34 of them.

The contractor to cut all holes in masonry for pipes, and to allow for the same, beyond pipe-holes described, the sum of £30.

Staircases.

To execute, in Portland Stone, the following staircases:—

One to the London-Assurance offices. — This staircase to be in two flights to the first floor. No. 1, solid white bottom step, 1 solid step on it, 20 fliers, 28 winders, and 2 landings; the steps and landings 5 ft. 3½ out of

the brickwork, and 8½ inches in brickwork pinned in with cement; the clear width of tread to fliers, 10½ inches from riser to riser, and the moulded nosings to all to project 2½ inches; the winders to be as wide as the space will admit, and to be finished with circular ends next well-holes; the two bottom steps to have moulded nosings, both faces with semi ends. Plain fair soffits to steps and landings; the landings 7½ in. thick; the top landing in three large stones, with joints joggled, and run with lead. Cut mortices for iron railing, back-joints to flooring and paving, and rebated joints to all steps including landings. This staircase to be carried up to the second floor the same as below, excepting that the steps are to rise 7 inches instead of 6½ inches, with 10-inch net tread, and nosing projecting 2 inches only. All other points similar.

One to the unappropriated Offices, North Side.—The staircase to be similar in construction to the staircase to the first floor of the London-Assurance offices, but smaller; the steps and landings 4 ft. 3 out of wall, and 8 inches in wall, and the half spaces and landings as is shown in the drawings. The width of tread and rise, the moulded nosings, and the two bottom steps will be similar to the former; to comprise three landings, two bottom steps, nineteen fliers, and thirty winders.

One to the Royal-Exchange Assurance.—To be like the London Assurance, but the rise to be 6 inches only. The landing, mezzanine floor, to be in four stones, 7 in. thick, and the staircase continued to the first floor; one of the winders to be of extra width, to give access to water-closets; 7-in. landing one pair floor, in five large stones, and moulded step to be fixed in large opening on west side.

One to the Banking-house.—This to ascend to mezzanine floor only; the steps, 10 in. by 7, net width and rise, and nosing to project 2 inches; the steps, 3 ft. 7 out of wall, and average 7 inches in; the landing to be 5 inches thick, with a riser; twelve steps, fifteen winders, and one landing. To fix paving to match in all door-ways.

To execute, in YORKSHIRE STONE, staircases as follows:—

Those to the basements belonging to the Royal-Exchange Assurance, the London Assurance the Banking-house, to the unappropriated offices, and to the basement of Lloyd's; in all five staircases. These are all to be of plain tooled *York*, as shown in the plans. The bottom steps to bear on brick footings, and all other steps to be pinned in, in Roman cement, There are to be twenty risers to all (one riser is always provided in the description of the paving on the ground story); and each of these staircases is to consist of nineteen steps, part fliers and part winders; the dwarf walls, under bottom, to be two courses in three bricks, and three courses in two and a half bricks; the ends to be tooled fair, the joints rebated, and mortices to be cut for iron railing; the treads of fliers 10½ net, and rise 7½ net. The steps 3 ft. 6 out of wall and 9 inches in. The steps to the basement staircase of the Banking-house, 3 ft. 1 only out of wall, and the footings under bottom step one and a half brick instead of two and a half bricks; and so on the same.

To construct staircases of *York* stone, from the great vault to ground floor, and from thence, with *Portland* stone, to offices on the mezzanine floor, each side of tower: see the plans. The stairs to basement to be tooled *York*, with fair tooled soffit. The stairs to mezzanine story to be rubbed with fair tooled soffit. The landing, ground floor, to be formed of 7-inch rubbed *York* landing, pinned in 7 inches, and the joints to be joggled and run with lead. The *Portland* steps to have 10½ in. net tread, and 7 in. net rise, and to be 3 ft. 8 out of the wall, and 8 in. to be pinned in in Roman cement. Fair tooled soffit to landings, ground floor.

To construct staircase to Lloyd's rooms of *Craigleith* stone; the steps 12 in. net tread from riser to riser, and 6¼ net rise, with moulded nosing, projecting 2½ in., and the soffit of the steps to be cut and moulded. The staircase to consist of two bottom steps, with semi ends, five quarter spaces, forty five fliers, and one great landing. The steps, 7 ft. 9 out of wall, and 9 inches in; the quarter spaces 9 ft. square, each in one stone; the landing, one pair, 7 ft. 2½ out of wall, and 9 inches in, net; the bottom steps, 10 ft. 2 by 3 ft. 5, and 6½ in. thick; the second step 9 ft. 3 by 1 ft. 5, and 6½ in. thick. These to have semi ends, and to have moulded nosings on both faces. The fliers out of stones 8 ft. 6 by 1 ft. 5 by 8; the quarter spaces 8 inches thick. No. 16 panels, 3 inches deep, to be sunk in quarter spaces and one-pair landing, with a moulding worked round them 4 inches girt. The one-pair landing to be in three stones, two equal to 13 ft. 5 by 8 ft. 6, collected, and one 3 ft. by 8 ft. 6. Work five lengths of 1¼ flush bead in soffit of landings.

All these staircases to be made complete, making good to flooring and paving; and 3-in. paving, to correspond with staircases and landings, to be fixed in all doorways. All joints in landings to be joggled and run with lead, and all ends of steps finished to correspond with fronts, mitred and stopped where needful. All requisite holes and mortices to be cut.

Slabs and Hearths.

Basement.—Lay rubbed *York* hearths to three chimnies, and also 2-inch *Portland* slabs, one 54 in. by 20 and the other 66 in. by 24.

Ground Story.—Lay 2-inch rubbed *York* hearths to all chimnies. Lay a 4-inch rubbed *York* slab, 48 by 48, for stove in Banking-house, and also inch veined marble slabs, 54 in. by 24, to the chimnies in the rooms adjoining. Fix in all the shops 3-inch rubbed *York* slabs, 36 in. by 24 for stoves.

Mezzanine Story.—Two-inch rubbed *York* hearths to all chimnies. Lay 2-inch *Portland* slabs as follows:—One 66 in. by 24, and one 51 in. by 18 to offices, south-west angle; two 54 in. by 21 to rooms adjoining tower walls; and two 58 in. by 24 to rooms in north-west angle. A 3-inch rubbed *York* slab in scullery, 48 in. by 30; and one in kitchen, 60 in. by 24. Fix in all other rooms over shops, slabs similar to such as have been described for shops.

One-pair Story.—Two-inch rubbed *York* back-hearths to all chimnies. Fix in Royal-Exchange Assurance offices six 1½-in. veined marble slabs, three of them 60 in. by 21, one 60 in. by 24, and one 66 in. by 24; also one 1½ in. similar slab in court-room, 84 in. by 30; also five 2-inch *Portland* slabs, one 43 in. by 20, two 51 in. by 20 and two 57 in. by 20. Fix in offices of the London Assurance, four 1½-in. marble slabs, 66 in. by 24, and two others, 60 in. by 24; also three 2-inch *Portland* slabs, 60 in. by 24. Fix in Lloyd's rooms 2-inch rubbed *York* hearths to all the chimnies; and four 1½-in. veined marble slabs, 78 in. by 30; and also four 1½-in. veined marble slabs, 60 in. by 24, and two 2-inch *Portland* slabs, one 69 in. by 24, and the other 60 in. by 20. Fix in rooms of the unappropriated offices in north-west angle, rubbed *York* hearths to all the chimnies, and three 1¼-inch veined marble slabs, one 72 in. by 27, one 66 in. by 24, and one 54 inch. by 24; also three 2-inch *Portland* slabs, one 54 in. by 20, and two 60 in. by 20.

Second Story.—Fix to chimnies in rooms connected with the Royal-Exchange 2-inch rubbed *York* hearths, and eight 2-inch *Portland* slabs, averaging 52½ in. by 20. Fix to six chimnies in rooms attached to the London-Assurance offices similar hearths, and 2-inch *Portland* slabs, averaging 52 in. by 20. Fix to the two chimnies of upper rooms of Llody's similar hearths, and 2-inch *Portland* slabs 54 in. by 20. Fix in rooms in north-west angle, similar hearths, and 2-inch *Portland* slab, 54 in by 20.

Chimney-pieces, &c.—Fix to three chimnies on basement and one in mezzanine floor, and two on one-pair story, and two on the second story, *viz.* eight in all, 2-inch *Portland* jambs, 9 inches wide, and haunched mantels, 10 inches wide, with fair edges and proper cramps. Fix also in the 36 shops, and in the 36 rooms over them, 1½ inch *Portland* slabs, 3 ft. by 3 ft., with fair edges, and holes cut for iron flue-pipes; all these to be securely cramped. Fix in other rooms 25 *Portland* chimney-pieces of the prime cost value together of £62 9*s.* 6*d.*; also 27 marble chimney-pieces of the prime cost value together of £635 15*s.*; also three sets of marble lining for stoves, of the prime cost value together of £15 15*s.* These prime cost values to be exclusive of cartage and fixing.

Provide and fix the following masonry in forming areas, curbs, and landings to shop doors, and other works to the outside of the façades.

Ft.	In.			£	s.	d.
1326	0	sup.	6-inch rubbed *York* in landings, to doorways, area curbs, steps, &c,	-	-	-
318	0	„	Plain works to joints	-	-	-
331	0	„	„ rubbed to edges	-	-	-
54	0	„	Sunk work to edges	-	-	-

Ft.	In.		£	s.	d.
93	6	„ Circular plain work, rubbed - -			
260	8	run Rebate and back joint - - -			
168	0	„ Cutting and pinning - - -			
No.					
214		Corkings cut for gratings - - -			
82		Double plugs and lead - - - -			
38		Cutting holes for scrapers - - -			
8		Stones 36 in. by 36 by 4, for coal plates, and a rebate hole in each - - -			
		Provide for sundry cutting and notching to plinths -	10	0	0

External Pavings and Steps.

The granite paving of Great Area is described. To fix round the same 6-inch *Craigleith* landing, laid with a fall and back-jointed to cast-iron gutter, to be in large stones 5 ft. net width, and the angle stones 6 ft. 1 square, extra sunk on the top and back-jointed for step of Ambulatory. To fix all round Ambulatory wide *Craigleith* step, rebated for landings last described and back-jointed, for paving of Ambulatory. This step in long length, 2 feet wide and 7 inches thick. To lay the Ambulatory with 6-inch *Park Spring* landings in large stones, as is shown in plan No. II., and with margins and squares formed by 2-inch *Kerry* slate stone 18½ inches wide; the whole to have fine joints, and to be cut and fitted as shown in the drawing.

The steps of Portico to be *Craigleith*, 16 in. by 7, with rebated back-joints. The top step to be 6 ft. 9 wide, in 7 large stones, and curbs 12 by 7, of *Craigleith*, to be fixed in front of columns. The whole of the portico and west entrance to be paved with 5-inch *Park Spring* landings, in large square stones, as is shown in plan No. II. The other entrances, that is the south, north, and two at east end, to have *Craigleith* steps, 16 in. by 7, in long lengths, and 5-inch *Park Spring* landing paving in large stones, Some of the steps will be wider, as is shown in the drawings, and as will be directed.

The East area to be paved with 5-inch *Park Spring* landings, in large stones, laid to currents; and cut four holes for pipe-heads in the same.

All these pavings and steps to be rubbed and laid with great accuracy, in regard to levels and joints; the joints to be fine chiselled, and the whole set and jointed with fine mortar. The steps bedded solid in brickwork built for that purpose. All the pavings to be laid upon a bed of fine concrete 6 inches thick, laid, beaten down, and floated to a fair face. The pavings and landings in the two open areas to have also a coat of *Claridge's* asphalte laid under them one inch thick. Fix grates and pipes to carry off water from east area, of the prime cost value of £35.

The contractor to provide and fix 10,000 feet cube of *Portland* stone, where the architect shall direct, including all labour in working and setting; and to execute this, or other work equivalent thereto, to the extent and value of £3000.

All works hereinbefore described to be done, and for which certain specified quantities are given, are to be measured; and any excess or deficiency therein in quantity or value shall be allowed according to the terms of the contract.

(To be continued.)

PRESERVATION OF TIMBER BEARINGS.

When the thickness of a wall does not exceed 18 inches, the bearings of oists laid upon it, are about a third or half of this thickness; when the walls are thicker, and the joists have any considerable scantling, the bearings may have as much as a foot; but when the walls have less than 18 inches thickness, the bearings should occupy the full thickness of the wall, for the slight parts of the masonry extending outside the joist would be most liable to be chipped off under pressure or vibration; and in this latter case, it may be necessary to reduce the number of the bearings of the joists by the introduction of trimmers.

By giving considerable bearing to a joist, we obtain not merely a support, but to a certain extent, a *fixing* of the end, by which means we considerably increase the strength of the timber, (in about the ratio of 5 to 3) but besides this, the vibrations which result from motion on the flooring are lessened on the ends of the timbers, and have not therefore such a destructive influence on the walls, more particularly on the surfaces of the walls; if the joists have but slight bearings—more especially in walls which are not of the best materials and workmanship—the vibration from the floor acting on the full extent of length of the timber, communicates a leverage which shakes the bearing, and which is consequently most injurious to the safety of the wall.

It is very common for the bearing timbers of floors to rest on wall plates, sometimes partly, and sometimes entirely, buried in the wall, over the whole extent of which any vibration is then carried, and thereby its effect lessened. By this means, however, the thickness of the walls is lessened also, and although there is not less strength so long as the timber of the wall-plate remains sound, it is very different when the wall-plate decays, inasmuch as a certain volume of rotten wood occupies the place of sound material, and the whole support of the floor is destroyed.

Girders, having a much greater area of flooring to support, are more deeply buried into a wall, and their bearings should always be made as perfect as possible, by bedding on a block of wood or stone, and unless we are using very superior materials, it is always better to build up from the foundation, under the ends of girders, a good pier of sound stone, which may or may not project as a pilaster.

It should always be remembered, that the mode of fixing timbers into the sides of a wall has quite as much effect on the stability of a floor, as any other means of ensuring its strength. It is a matter of constant observation, that whilst the extremities of timber, buried in walls, rapidly decay, all else in the wood exposed to the constant effect of the atmosphere, remains sound as when first put up; and it is this which has introduced a system of laying the ends of joists of floors on plates supported only by stone or metal corbels. The decay of a girder at the bearing is a matter of most serious import, both as regards the soundness of a building, and the safety of human life; the security of the whole area of a floor may be jeopardized by such a circumstance, and the expenses of such repairs are always heavy.

The deterioration of the bearings of timber has been attributed to the effect of mortar, composed of lime and sand, decomposing the wood and causing its decay; but the same has been observed where nothing but clay had been used; even in cases where no mortar of any kind had been employed and where the fixing of the extremities of girders had been effected solely by their juxtaposition with the sides of stone, still decay ensued at these ends of the timbers. It is now generally acknowledged, that humidity, absorbed by, and closed up from the air, in contact with the wood, is the only cause of the decay of the bearings of girders and joists, and several attempted remedies have been applied to counteract this injurious consequence, which is more fatal in a damp climate than in a dry one. One method, which if not perfect, at least delays the coming mischief, is to leave an open space between the extreme end of the timber and the exterior of the wall, and only to fill up this space when the walls are perfectly dry.

Another method has been to extend the timbers to the outside of walls, as may be seen in some ancient buildings, churches especially, and this has been found effective where the eaves projected sufficiently to afford shelter from the rain; but if the walls are very thick this occasions a length of bearing beyond that which is necessary to ensure a sound fixing on the walls, and to obviate this increase of length, it has been customary to give only the length of bearing considered sufficient for this purpose, and to effect the fixing merely by lateral juxtaposition; at the end of the timber, an open space, equal to the sectional area of the timber, is left right through the wall, and this opening is closed up by a stone pierced with a number of holes sufficient to effect a communication between the opening left and the exterior air. This precaution is an improvement, but it will not prevent the masonry from communicating humidity by its contact to the wood, from which fermentation will ensue, and consequently decay of that portion of the wood composing the bearing.

Freedom from damp, and a good circulation of air round the wood, are the most efficacious means of ensuring preservation. The best method is to make the timbers bear on projections of stone or iron, which should be tailed deep into the walls, and these projections should be sufficient to afford

a full and sufficient bearing, and besides a space of about half an inch between the extremity of the timber and the face of the wall. The more effectually to prevent all access of damp from the wall to the end of the timber, a thin sheet of lead may be applied, though we rather doubt the advantage of this, and the projection may be so pierced as to allow the air to reach, to some extent, the underneath surface of the bearing of the timber.

In taking down a few years ago, in France, some portion of the ancient chateau of the Roque d'Ondres, it was found that the extremities of the oak girders, lodged in the walls, were perfectly preserved, although these timbers were supposed to have been in their places for upwards of 600 years. The whole of these extremities buried in the walls were completely wrapped round with plates of cork. When demolishing an ancient Benedictine church at Bayonne, it was found that the whole of the fir girders were entirely worm-eaten and rotten, with the exception however, of the bearings, which, as in the case above mentioned, were completely also wrapped round with plates of cork. The fixings were completed by a layer of greasy-feeling clay, interposed between the cork and the masonry, and the parts of the walls opposite the ends of the timbers were of brick. It would be very difficult to believe that these extraordinary instances of the preservation of timber were not to be entirely attributed to the cork plates, the impermeability of which is well known, since the substance is not only used to contain different kinds of liquids, but also to close bottles containing spiritous liquors. With experience saying so much in favour of a process so simple and inexpensive, it must be acknowledged that it deserves to be tried, more particularly for buildings of which we are more than usually anxious to preserve the timbers.

With regard to enveloping the ends of timbers in sheetings of lead, copper, or zinc, it must not be forgotten, that unless the wood be perfectly dry, this process would be more likely to effect a rapid decay of the timbers which it was attempted to preserve, and this by closing all the pores by which any remaining portion of humidity might escape.

WATERAGE.

HENLEY AND LONDON WATER-WORKS AND NAVIGATION.—London, the most important, and the richest metropolis in the world, is supplied with dirty water, and this even most inadequately and insufficiently; much of the supply is from the Thames, polluted by the sewers with the filth of houses and with the surface drainage of the streets, ill cleansed, and always covered by a layer of mud, ever containing a large portion of decaying organic matter, and after contact with cesspools, gas pipes, and the rotting remains of mortality in our reeking chuchyards. We know, and admit, that the various waterworks companies have made costly endeavours to remedy the evils under which they labour to supply pure water; but the community does not suffer the less; the efforts they make to purify the filth they pump up, is by filtration, and supposing, and it is only supposition, that this separates the matter contained in mechanical suspension, it does not purify the water of that held in chemical combination, and we know that this is in considerable quantities. But even if it could be thought that this would be borne much longer by our immense population, the intermittent system with the dirty cistern, water butt, ball-cock arrangement, is sufficient to render a better supply most imperative. With these feelings we hail the announcement of a "Supply of Water to London by means of the Henley and London Water-works and Navigation." The engineers are Messrs. Mc'Lean and Stileman, and Thos. E. Blackwell, the latter of whom is engineer to the Kennett and Avon Canal Navigation.

With the intermittent system the cistern and ball-cock is a necessary appendage to the supply of houses, and it is an expensive one; besides, this water in the cistern is always liable to pollution from without, and ball-cocks are ever out of *order*, and unless, with this precarious means, the inhabitants of a house are on the careful look out, they are liable to be without water for two or three days; and supposing all in order, however numerous the inhabitants of a house, and whatever their wants, they must, during the hours of supply, and howsoever inadequately supplied with storage room, take sufficient or go without; and when the water falls short, what is the state of the water closets? With regard to the flushing of sewers, a fully acknowledged requisite for sanitary purposes, the intermittent system is again fearfully at fault; here, take as one instance in many, the fatal cases of cholera in Hair Brain Court, Rosemary Lane, where according to the report of Mr. Lovick, upon their arrival with pumps and hose, they were unable to obtain any water for upwards of four hours, in consequence of the main not being charged. Again, in cases of fire it is indeed too notorious, that by the intermitting, or used up system, water is hardly ever to be obtained when most needed. This defect in the system is also so fully acknowledged, that a more adequate supply of water to a town has a decided and material effect on the rates of insurances. There take the case of Liverpool in 1845, when the following document was issued by the Imperial Office. "The subject of the present rates for mercantile insurances at Liverpool, having been taken into consideration by the insurance offices, and particularly the circumstances that the measures for providing an ample supply of water in the warehouse districts were in a great state of forwardness, it was determined, that in anticipation of the early completion of the works for rendering that supply of water available for the protection of the warehouses, the rates for mercantile insurances at Liverpool be immediately reduced." The same thing was fully expected in Manchester, from the introduction of a constant supply. At Preston, in Lancashire, the supply is constant, that is, the water is always in the pipes, and under a certain pressure; no less than 6000 cottages are here fitted up to receive the water into the tenement *at any time*, for 16s. each, and a fourteen inch main, under 82 ft. pressure, supplies 50,000 inhabitants, with an average of nine gallons per individual, besides the supply to factories and workshops, which are here very numerous. With regard to fires, the town of Preston has afforded numerous examples in cotton mills, which are very combustible, where by the help of the workpeople alone, fires have been most easily extinguished from the water being always on in the pipes which are carried up to every floor; now any person conversant with Lancashire, is well acquainted with the fact, that the most destructive fires are continually occurring in this county, and that a case of non-insurance is quite an exception with regard to cotton mills; but it appears in Preston it is a common thing not to insure. Much has been said with regard to the danger of the taps getting out of order and leaking in parts of a town under high pressure on the constant system, but this has been contradicted by experience.

In proof of the superiority of this system, almost every plan, proposed of late years to our towns and cities, has been on the constant system. Why is London to be more slighted than any of our country towns? This alone is a source for rejoicing at the announcement of the Henley and London Water Works, which offer a better supply of better water, and therefore increased means of cleanliness, and consequently a decrease of moral degredation.

We now extract from the pamphlet:—

"To supply this avowed want in London by means so copious as to be equal to any extension of the population which need be contemplated, so simple as to insure economy, and at the same time with due regard to the large interests already vested in existing water-works, is the object now in view; and if, on the one hand, the pecuniary circumstances of the day seem adverse to the success of this project, on the other hand, the public necessity of some such undertaking was never more urgent or more universally acknowledged; and those very pecuniary circumstances will relieve the promoters from the imputation of embarking in this great work with exaggerated hopes of private profit.

The conditions deemed essential to the undertaking are, that the water be as pure as can be attained; that the quantity shall be so abundant, for all private and public purposes, as to be within the reach of the very poor; and that it shall flow from such a level as to insure constant high service over the greatest part of London without mechanical power.

The source intended to be resorted to is the Thames, in the neighbourhood of Henley, from which the stream will be conveyed with a very gradual decline in a navigable channel nineteen miles in length, until it reaches the Grand Junction Canal at West Drayton, whence it will be

conveyed to London, either in the bed of that and the Paddington Canals, or in a separate channel alongside of those navigations.

A reservoir will be formed at Paddington, 103 feet above low-water mark of the Thames, a height sufficient to supply the upper floors of very far the larger number of houses in London without mechanical power. It is also proposed to have a high service reservoir on Primrose Hill, which will be supplied by a very simple hydraulic power obtained from the fall of the water to the lower parts of London.

The experience derived from previous inquiries, and the concurrent testimony of scientific men, have pointed out the Thames as the only adequate source for the supply of the two million persons densely congregated in what, by popular estimation, may be termed London; and the selection of the water of that great river is approved by the necessities of existing Water Companies, nearly all of which resort either solely or principally to that source. The waters of the Verulam, the Colne, and the Brent, are not sufficient for the supply of London, even if no objection arose from their hardness, and if it were possible to overcome the well or ill grounded opposition of mill owners, whose property depends on maintaining the integrity of those streams.

Upon Artesian Wells scarcely a single engineer would rely for the constant and chief supply of a vast population. Their inadequacy, unless they penetrate the chalk stratum, is admitted by their most zealous advocates. What effects may be produced on them when resorted to for one hundred millions of gallons daily, and how such an exhaustion, if possible, would effect those streams in Hertfordshire already alluded to, which are derived from the chalk formation, are questions which can only be answered at an enormous cost and commensurate risk. And although Artesian Wells, sunk only into the sand, give a remarkably soft water, it may well be doubted whether water pumped from a bed of chalk will not have a hardness which will render it unfit for domestic purposes and injurious to health.

But it is another and insuperable objection to the adoption of Artesian Wells, that the water in them rises only, on an average, thirty feet below low-water mark at London Bridge, and that mechanical power must therefore be constantly employed according to this system.

The Thames being thus (almost of necessity, certainly most wisely) the source selected, Henley was resorted to, partly because of the purity of the water there, partly because the level of that reach of the river is 106 feet above low-water mark at London Bridge; and, by maintaining that level, with a decline of only three feet into Paddington, a reservoir may there be formed somewhat above the level of the New River Head, from which water will flow by its own gravitation to the upper stories of most of the houses in London, and all the houses in Westminster and the City; whilst by the fall of the water thence to the lower parts of London a mechanical power (it may be repeated) is derived which will fill the high service reservoir at the top of Primrose Hill; a situation which commands the highest part of London and its neighbourhood.

It is needless here to enlarge on the advantages derived to the consumer from a perpetual flow of water in any part of his house without the intervention of cisterns, and the machinery attached to them. To the labouring classes, whose dwellings are often confined to a part of a single floor, the advantage of having water perpetually within reach is manifest: and that this continual supply is not injurious to Water Companies, if they have a quantity of water sufficient for the wants of the population, has been proved by the evidence of the most eminent engineers to those bodies.

The quantity of water intended to be supplied to London is one hundred million gallons daily; and the present design is not to embark in a competition with established Water Companies, but, on the contrary, to contribute to the efficiency and succcess of those bodies upon conditions advantageous to the Public; by enabling the companies, each in its own district, to give to the smallest house in its own limits all the water its inhabitants can want, by perpetual high service, and at a cheap rate. Abundance will still remain to fill the ornamental waters in the parks, to supply fountains, and, above all, to cleanse the drains and sewers of the Metropolis.

The channel between Henley and West Drayton will be navigable, and will have the effect of diminishing the navigable distance between Henley and London by more than twenty miles. A uniform surface will be preserved throughout the whole distance; and, to maintain the purity of the water, the bed of the whole channel will be formed of concrete.

If objection is urged against this part of the project, either because it interferes with the existing rights in the navigation of the Thames, or because it may tend to unfit the water for domestic purposes; the former, merely financial impediment, admits of not difficult arrangement, and the latter will be removed by the reflexion that 100 barges a day can produce no effect upon the vast body of water in question; whilst the purity must be deemed absolute, when compared with the water of the Thames even at Chelsea, which has received between that point and Henley the drainage from a population exceeding 75,000 persons, besides the contamination derived from the sewerage of London brought up by the tide, and held in perpetual suspension by the perturbation of steam-boats.

The cost of the undertaking is estimated, and, as the promoters believe, largely estimated, at £750,000. If, however, upon more mature deliberation, it should be found expedient that a separate channel should be made for the water for the whole distance, £250,000 must be added to the expense.

In calculating the revenue to be derived from the undertaking, large allowance has been made for the necessity admitted on all hands, and which will probably be enforced by Parliament, of diminishing the cost of water to the labouring classes. All the other Water Companies it can be proved, and to a certain extent the New River Company also, will find it more profitable to buy water from the proposed reservoir and let it flow down their mains, than to pump it from their present sources. Assuming them to pay only one penny for 1000 gallons, and that only one half of the whole quantity brought into London by the proposed means produces a pecuniary return, the net annual revenue will amount to more than 9 per cent on the original outlay: whilst the economy of machinery by the high level of the reservoirs, and the nearly unlimited quantity of water, will enable the various Companies, even with increased profit to themselves, not only to supply abundantly the meanest houses in London, but most materially to diminish their charges."

We have no means of going into the figures, but we trust that these, as well as the entire subject will be fully laid before the public, who will, we have no doubt, give it full consideration and aid. These are the reforms which we want; reforms which will render the home of every man, and the poor man's especially, more comfortable, and more happy.

Supply to the Borough of Plymouth.—Now, when the railway world is slumbering in a somewhat deathlike stupor, from the effects of indigestion, our engineers are turning their energies into other channels for the benefit of the community at large, and the more abundant supply of good water to our towns and cities, which has hitherto been most scanty for all sanitary purposes, has become one of the principal objects of attention. It will be well for the public if they give their aid to such important measures, so all-conducive to health and comfort, but especially of the suffering poor; and this more particularly when the work is taken up by such experienced men as Mr. W. Beardmore, who has addressed an important letter to Viscount Ebrington, M.P., on the subject of improving the water supply to the Borough of Plymouth. Several portions of Mr. Beardmore's letter—bearing, as they do in a practical manner, on the waterage, not only of Plymouth, but of large towns generally—we shall here extract.

" Twenty years since, an engineer deemed he was giving a fair quantity when he supplied 8 to 10 gallons per head to the population; now, it is generally allowed that this is utterly inadequate, and from 20 to 25 gallons* per head is considered the minimum allowance. I have lately been engaged in the improvement of the supply of water to the City of Edinburgh, and have found that there will be ample use for for 30 to 35 gallons of water per head per diem; while, in some extensive designs that I was engaged upon for improving the supply to Glasgow, (which is a manufacturing town,) the quantity was estimated at 50 gallons per head."

On the intense folly and perverseness of parish contracts—thanks to which we get blinded with dust in the spring months, and in summer well drenched in spite of our umbrellas, because the water carts innundate the streets during every shower, in this country, where " the rain, it raineth every day,"

* As much as 30 gallons has been insisted upon for domestic and sanitary purposes.—Ed

Mr. Beardmore makes the following practical commentary, without, so far as we know, intending it as such. "A most important matter of economy is in the use which can be made of water for street cleansing and summer watering. The general streets of Plymouth are well paved for cleansing by hose, and the cost of placing additional stand-pipes or valves, required as they are for other purposes, becomes a mere trifle. At a small expense, stand pipes, or a few more fire plugs than now exist, should be placed so that a range of hose from 100 to 200 feet in length can be attached, at least once a day, for the purpose of washing and watering. * * *

One man, with the head of water available, and the general rapid fall of the streets, could wash thoroughly 10,000 square yards per diem, or, at an average of 8 yards wide, 1,250 yards, or two-thirds of a mile of street, per diem. Now, in efficient hand-sweeping, one man can cleanse not more than 800 square yards, or 100 lineal yards, at 8 yards wide.

This is a cheap, simple, and efficient means to clean the streets, and carry off from the surface the putrid organic matter which so continually exhales its poison in the streets, to the disgust of our senses when they are awake, and for the engendering of disease—indirectly, at any rate, if not directly—more particularly in the narrow streets and courts densely populated by the poor, where the air is used enough without being further polluted. Will people see this?

Mr. Beardmore recommends the introduction of a systematic arrangement for a vertical pipe, with branches to the different floors, like the plan of supply up the common stairs of flats in Edinburgh and Glasgow, where, of course, each tenant is charged a separate water rent. "Now a charge of three shillings per annum, allowing a deduction of 25 per cent. for payment by the landlord, would at once bring accession of revenue to a large amount, and be an incalculable boon to the poorer community. An objection may be taken to the apparent expense of this arrangement; but if galvanized wrought iron pipes were used for the vertical pipes, it would be small. If a service were combined with a sink and waste-pipe for each floor, the cost would stand thus:—

Thirty feet of vertical iron pipe at 8d., fixed, including three branches	1	0	0
Three pipes and taps	0	10	6
Three sinks of slate, to be erected in staircase angle	1	4	0
Waste-pipe (stack-pipe available)	0	15	0
Cost per house with three floors	£3	9	6

This would be a charge upon the landlord, including interest and repayment of first expenditure, 1*l.* 3*s.* per floor, or per service; or, assuming two rooms let off per floor, having the joint use, his weekly loss would be $\frac{1}{4}$*d.* per tenant, which would be fully made up by the increased convenience of the lodging, as a merely voluntary question."

It is not only to the poor, all-important as considerations for this multitude should ever be made, but also to those who are better off, or pass as such; take the well-paid mechanic or workman—take the clerk, or even the professional man, who, because the housebuilders and landowners choose it, must be burdened with houses twice or three times too large, or else live in lodgings or apartments, where they suffer pre-eminently from want of water convenience, setting aside all the other miseries and discomforts which drive men from their homes. In such cases, every drop of water used in the first, second, and third floors has to be brought from the bottom, in buckets, in jugs, &c., and slopped over the stairs, which in many houses will not fail to be a source of disturbance. With such difficulties, how can they keep themselves clean? Who has a right to expect it? For every flight of stairs is a considerable and permanent increase of labour, not only as regards the greater height up which the water has to be carried, but because in the upper floors live the poorer people, whose narrow incomes compel them to do more for themselves.

Again, as regards fire, how many a lamentable loss of life might be prevented, how many a miserable case of burnt children would no longer be instanced, if there were on every floor of every house a flow of water ever ready at the moment of need?

Amongst the improvements proposed, are "the abandonment of the mill power in Plymouth, so as to have the water under control solely for town purposes.

Increase of head for fires, and for serving the whole Borough by a distributing reservoir near Torr, 275 feet above the sea.

Purity by storing, and by improving the lead course, and by delivering it by pipes from Manadon.

Permanency of supply of water from Dartmoor, by constructing a store reservoir at Sheepstor. This reservoir would be of 40 or 50 acres, with a depth of 20 or 25 feet.

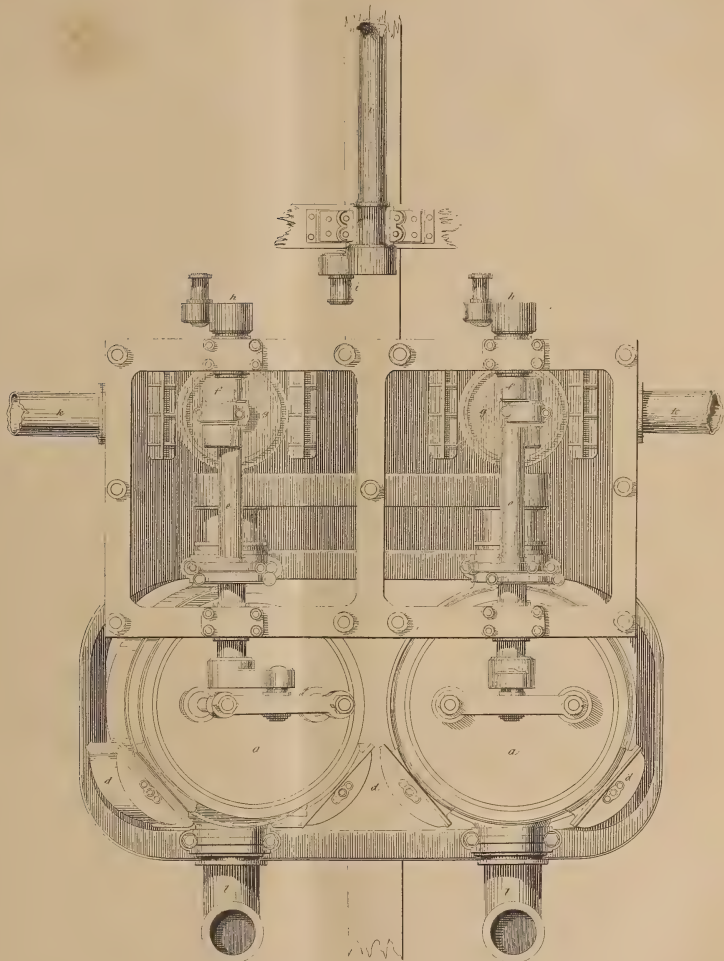
If fully carried out, the purest water, in sufficient quantity to supply 150,000 people with 36 gallons per head per diem, can be delivered into a settling and distributing reservoir 275 feet above high water, affording 60 feet of head to the highest parts that can be built upon, and distant only two miles from the centres of the towns of Plymouth, Devonport, and Stonehouse."

Altogether, the rough estimate is laid at £28,000.

A MODEL DAIRY.—The *Farmer's Herald* gives the following description of Mr. Littledale's dairy at Liscard, in Cheshire. "It is a large oblong-square room, elegantly fitted up. The floor is formed of Keene's Patent Cement, of a chocolate colour, and was laid in one piece; but, by white lines of composition introduced, let into grooves made on the surface, it resembles fine pavement in large squares. There are two large tables, one on each side, made of sycamore, with turned pillar legs of the same, and the whole of almost snowy whiteness, from washing. There is a massive marble table at the farther end. Three very large octagonal-shaped leaden milk coolers stand in the centre, each on an ornamental pedestal. The walls above the stables, to the height of about twenty inches, are lined with glazed Staffordshire tiles,* resembling small squares of veined marble. There are ten square ventilators round the roof. The roof is of the pavilion or eaved form, groined with a handsome foliated centre piece, which being in open work, leads the air to a large ventilator at the top of the building. The walls more exposed to the sun are built with a hollow space of three inches in them, through which a current of air passes, and there is a double ceiling, for the same obvious purpose of keeping an equal temperature in summer and winter. The milk dishes are all of glass, of various sizes. and both round and oval. These (glass being a non-conductor) are, for the preservation of the milk, and for throwing up the the cream, found to be superior to vessels of the usual materials. The room is, in fine, a perfect model of a dairy. in elegance, cleanliness, and adaptation. The milk-kits, or pails in which the milk is brought from the shippoons, are all beautifully made of sycamore, and are kept so clean that the wood, like the tables, is white and spotless, and the iron hoops of dazzling brightness. Close to the dairy, and under the roof of the manager's house, there is a handsome and well-furnished sitting or refreshment room for the use of the proprietor of the farm, whose own mansion is is at some little distance, near Egremont Church. The whole of this establishment is managed, *within doors*, by four women servants, besides the active female housekeeper, who has had great experience in domestic farm arrangements, and three men servants, sometimes four. * * * Near the entrance gate is a weighing machine, with an indicator in the adjoining cottage, by which loads of hay, roots, &c., can be weighed, and the live weight of cattle accurately ascertained. The whole of the buildings are most effectually spouted, and the water is carefully carried to a large pond, by drains, independent of those for the liquid manure tanks. Our authority informs us that a spirit of emulation has been excited among the neighbouring farmers, and that all around Liscard improvement is on the march. The greatest praise is due to Mr. Littledale for the practical example he has set; such patriotism is worth a folio of parliamentary speeches."

OVENS.—After mentioning the failure of iron when applied to the construction of ovens for baking bread, and the total inapplicability of brick, which from its porous nature absorbs the moisture of bread, Mr. J. De la Haye, in the *Mining Journal,* mentions a patent, obtained he believes in Germany, for constructing ovens with stone. He says, that in some parts of the Continent ovens are constructed entirely of granite, requiring of course a great deal of fuel to heat them; but then they retain the heat a long time in proportion. Bread, baked in these ovens, will keep fresh as many weeks as it would days if baked in brick ovens, and the crust is so thin and moist, that it may be cut with a penknife. Still he believes it possible to construct ovens with either wrought or cast iron, which would be more convenient, as the fire could be placed under them. All that would be required to prevent the bread from being injured by the heat, would be to pave the floor of the oven with a thin layer of hard stone, on which the bread would be placed. The heat would have to pass through iron and stone, so that it could never pass too rapidly. The oven should be surrounded by an arch of brick, leaving a space of six inches between the iron and the arch, in order to allow the flames to extend over it before reaching the flue.

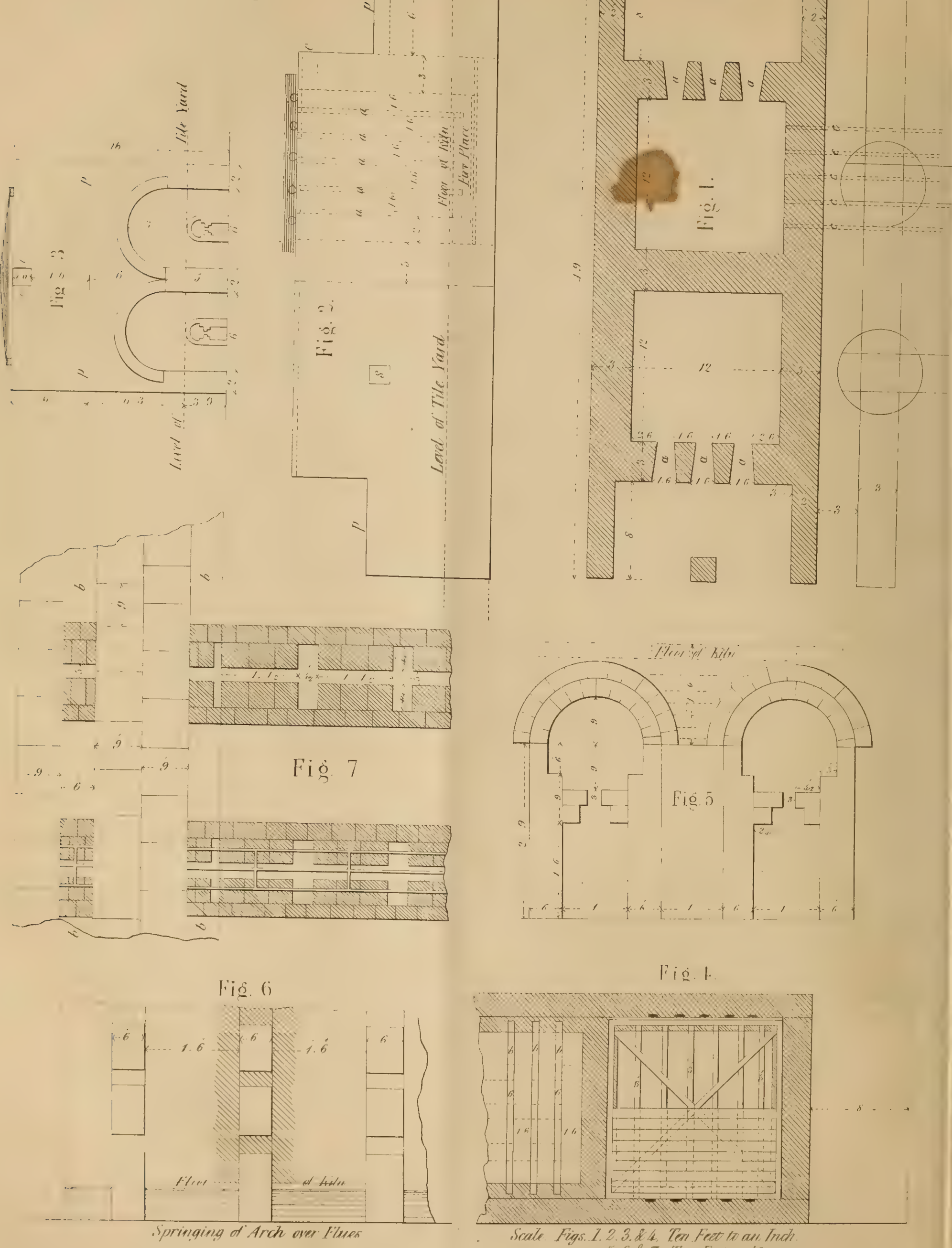
* We wonder these are not more commonly used.



LONDON WALL.

IMPROVED DOUBLE KILN

FOR PIPE TILES



Scale Figs. 1. 2. 3. & 4. Ten Feet to an Inch.
5. 6 & 7. Two Feet d^o

Aruzan 1849

THE ARTIZAN.

No. III.—Fourth Series.—MARCH 1st, 1849.

MECHANICAL ENGINEERING.

ENGINES FOR DRIVING THE SCREW.

We have the pleasure of introducing to our readers this month a novel design for Marine Engines, adapted to screw propulsion, and intended to act upon the screw shaft without the intervention of toothed wheels. This plan has originated with Messrs. J. and A. Blyth, of Limehouse, and embraces, amongst other improvements, the patent two-piston-rod oscillating engine of that firm.

This plan restores to screw propulsion the advantages of an already well-approved construction of engine, of which we regret to say, it has too long been deprived. Indeed, there is scarcely any mechanical combination which had been previously condemned, but which has been resuscitated to form some part of a pair of engines for the screw, and no established practice, but which has, on the other hand, been completely set aside.

This design is extremely compact, bearing a comparison in this respect with all the more recent inventions, and surpassing some of them considerably. Perfect security from shot is obtained by the machinery being far below the water line, and at the same time, the parts of the engines are all easy of access and repair—a most important point, but one often sacrificed to compactness.

A saving in height is effected by the use of two piston rods, which permits the cross head to dip between them, and this plan is also adopted, we believe, with a view to distribute the strain over two rods rather than one.

There is some peculiarity in the method of applying the power of each engine to the screw shaft. This is shown in Fig. 1, where the three connecting rods which are required to couple the different cranks are formed into a triangular frame, producing great simplicity in the arrangement. The air-pumps are worked as in ordinary oscillating engines, from cranks in the body of the main shaft, and thus may have the velocity of the motion of the air-pump buckets reduced to the ordinary standard.

Marine engines intended to work directly on the axis of a screw propeller must of course work at a much higher velocity than the generally received standard of Boulton and Watt; and in consequence of the increased velocity thus required from the pistons, the diameter of the cylinder is made so much less than the usual standard. In order to secure this great velocity to the pistons, the steam and eduction passages are made unusually large, and by due attention to these proportions, a velocity of 370 feet per minute has been obtained.

In a condensing engine, the limit to the velocity at which it may be worked has usually been determined by the velocity of the water pumped out by the air-pump, and it certainly does appear that a velocity of 110 to 120 feet per minute, which is the maximum allowed in engines of Boulton and Watt's standard, is about the greatest that can be given to a pump with safety; when the velocity of the water exceeds this, the quick motion of the bucket communicates to the water a series of blows, the shock of which causes, generally speaking, the destruction of the material. Notwithstanding this acknowledged impediment to pumping above a moderate velocity, several screw engines have been made with the air-pumps working at the same length of stroke as the pistons, whilst the latter are intended to move at the high velocity above stated. It is true, that every appliance has been tried to diminish the violence of the shocks to which the water is subjected, and canvas, or other elastic valves, have been successfully used. In our opinion, there is nothing however, to warrant the use of air-pumps at such a high velocity, and we think that a return, as in the design before us, to the ordinary method, is to be welcomed as promising some relief from the uncertain style of performance by which engines of this class have been hitherto characterized. We hope shortly to be able to lay before our readers several other designs for screw engines, and we shall reserve until then, some other remarks which we have to make on this interesting subject.

The letters in the different figures refer to the same parts in the explanation:—

- *a a* the steam cylinders.
- *b b* the piston-rods and cross-heads.
- *d d* the slide valves.
- *e e* the main crank-shafts.
- *f f* cranks to work air-pumps.
- *g g* the air-pumps, which being double, discharge during both the up and down strokes.
- *h h* the cranks to drive screw-shaft.
- *i i* the axis of the screw.
- *k k* the discharge pipes.
- *l l* the steam pipes.

The feed and bilge pumps are not shown, being worked from the trunnions of the cylinders in the ordinary manner.

MR. WHITELAW'S EXPERIMENTS ON THE RE-ACTION WATER-WHEEL AND THE CENTRIFUGAL PUMP, WITH DESCRIPTION OF A RE-ACTION WHEEL RECENTLY ERECTED BY HIM IN THE WORKS OF MR. JOHN POYNTER, SHAWSWATER, GREENOCK.

(Continued from p. 240 of last vol.)

The results contained in table 3rd, new series, were obtained from a water-mill, and those in tables 1st and 2nd from a centrifugal-pump, with jet pieces of a form nearly the same as the jet pieces of the water-mill of 1.3 feet diameter which has already been described in the *Artizan*. Each jet orifice of pump and water-mill is 1.112 by .3084 inch, that is $1.112 \times .3084 =$ the area of each orifice in inches.

The results in table 4th were obtained from a water-mill with jet pieces of the form represented in fig. 4. Each discharging orifice is circular and is made in a thin plate of tinned iron, diameter at $c\,d$ and $e\,f$ $1\frac{3}{4}$ inches, and diameter $a\,b$ of orifices .83 inch.

The results in table 5th were got from the same water-mill last spoken of, after the thin plates with jet orifice in each .83 inch diameter were taken off, and replaced by two other thin plates of tinned iron with orifice $a\,b$ in each .706 inch diameter.

The thin plates with orifices in them of .706 inch diameter were then taken off the water-mill, and one of the plates with orifice .83 inch diameter in it was put on the one arm, and a tapering tube as shown in fig. 6 and of the following dimensions was soldered to the other, and with the machine altered as now described, the results contained in the 6th table were obtained. Diameter of jet orifice $a\,b$ .656 inch, length $e\,f$ 1.61 inches, and diameter $c\,d$ $1\frac{3}{4}$ inches.

The results in table 7th were got from the water-mill after the conical tube that has been described was taken away, and another conical tube of the dimensions as under put in its place, length $e\,f$ 1.276 inches, diameter of jet orifice $a\,b$ .667 inch, and diameter $c\,d$ $1\frac{3}{4}$ inches.

After the tube last described was taken off the water-mill, and replaced by another conical tube of the following dimensions, the results contained in table 8th were obtained. Diameter of jet or discharging orifice $a\,b$ .652 inch, diameter $c\,d$ $1\frac{3}{4}$ inches and length $e\,f$ 2.29 inches.

When the experiments, the results of which are contained in tables 9th, 10th, 11th, 12th, and 13th were made, both plates with orifice of .83 inch diameter in each, were on the water-mill. The jet piece of the one arm was the same as represented in fig. 4, but the jet piece of the other was altered to the form shown in fig. 5. The part A is solid and made of hard wood, and it was well greased before the experiments were made. Diameter of base of cone and cylindrical part of A .058 foot or nearly .7 inch height, or perpendicular altitude of cone 1.06 inches, distance from C to s 1.06 inches, from C to n .84 inch, from C to m .63, and from C to e .32 inch. The tube $d\,f$ is soldered to the arm, and the cylindrical part of A fits it tightly, and when the experiments, the results of which are contained in the 9th table, were made, the mark s on the piece A was in a line with the top end f of the tube, and in this case the base of the cone and the plate in which the orifice is made were in the same plane.

When the experiments, the results of which are given in table 10th, were made, the mark n was opposite, or in a line with f the end of the tube; when the next series of experiments was performed the mark m was set in a line with f; the results contained in table 12th were got from experiments made while the mark e was in a line with f, and the 13th series was performed when the mark C was in a line with f, the end of the tube.

For the benefit of those interested in getting up *jets d'eau* we may mention that when the mark s was in a line with f, the end of the tube $d\,f$, that is, when the base of the cone was in the same plane with the discharging orifice, the jet that issued was perfectly round, solid, and transparent in every part, and did not break or separate in the slightest degree till it struck the ground which it did at a distance of not less than 16 feet from the end of the arm it escaped from. As the cone was shifted back, or more of it was in the jet piece, the transparency and beauty of the jet became less.

By formula 7th, the numbers in the 6th column of table 3rd were calculated, and by the 8th formula the numbers in the 7th column of that table were obtained. Now, as the loss the water meets with in passing through the water-mill and pipes + the loss caused by the water leaving the machine with some force or power remaining in it, is = the whole of the non-available power of the water, we, by subtracting this sum from 100, the whole power of the water, should, if the formula be correct, get the per centage of power that can be realized by the water-mill; that is, if formulæ 7th and 8th are correct, the 9th column in the table above referred to, should be the same as the 5th, as the former contains the calculated results, and the latter the results that were obtained from experiment. The difference of the numbers in the 5th and 9th is given in the 10th column, and as the resistance due to the friction of the spindle of water-mill, and that caused by the atmosphere and by the spray, are not included in the calculated results, that difference is not greater than might be expected, and we therefore are led to conclude that the formulæ are correct.

The weight of the water-mill friction brake and spindle is about 7 lbs. less than is sufficient to balance the upwards pressure of the acting column of water against the water-mill, and therefore the resistance occasioned by the friction of the spindle would be greater than it would have been, had those pressures been in equilibrium, and this will account for at least, part of the difference of the numbers in the 5th and 9th columns of table 3rd.

As the loss arising from the friction caused by the upward pressure of the water not being exactly counterbalanced by the weight of the water-mill, &c., as also the loss, occasioned by the friction resulting from the pressure of the different weights used being transmitted by the arm of friction brake and the spindle to the bearings, can readily enough be calculated, we, to enable any one who may think proper to do so, shall here describe the journals and bearings. Each of the two journals of spindle is nearly $\frac{5}{8}$, and the collars at ends of journals about $\frac{7}{8}$ inch diameter. The bearings the shaft works in are made of mahogany, and only one of the collars, viz. the bottom one of the top journal, presses against the bearings. None of the top collars can rub against the bearings on account of the water-mill, &c. being about 7 lbs. weight less than is sufficient to balance the upward pressure of the water against the central part of water-mill; and as the bottom journal is longer than the breadth of the bearing which is placed midway betwixt the two collars, neither of those collars can rub on the bearing.

The 6th column in table 2nd was calculated by the 15th, and the 7th column by the 16th formula; and as the way in which the numbers in the following columns of that table were obtained, will, from what is already written, be understood, nothing more need be said about this.

It may be as well to mention, that the apparatus by means of which the pump experiments were made, is so constructed that by it either the whole power required to work the pump, or that portion of the power which is required to overcome the resistance of the atmosphere and the friction of the spindle, both when the pump is full of water and when it is empty, may be ascertained; and by means of said apparatus the entire weight it took to work the pump was first determined, and then the weight required to work the pump *when empty*, at different speeds, was ascertained, and the numbers in the 3rd columns in tables 1st and 2nd, were obtained by subtracting the numbers that represent the second from the numbers that represent the first, series of weight made mention of. As the amount of loss that arose from the friction caused by the weight of the water in the pump acting on the bottom of upright spindle, may be calculated, we, to enable any one sufficiently interested in the matter to do this, state that the bottom gudgeon or foot of spindle is .4 inch diameter, and works in a brass bearing, and 8 lbs. is the weight of the water in the pump.

About $8\frac{1}{4}$ inches of the outer end of each arm of the water-mill the experiments were made with, is parallel, and is $1\frac{3}{4}$ inches diameter, but from the inner end of the parallel portion the arm widens with a regular taper, and is fully $2\frac{7}{8}$ inches diameter at the place where it joins the central part of water-mill. From outer end to outer end of tapering part the distance is $15\frac{1}{2}$ inches, and $15\frac{1}{2}+8\frac{1}{4}+8\frac{1}{4}=32$ inches = the diameter of the water-mill. The central opening is $4\frac{1}{2}$ inches diameter. The whole of the experiments were made with the same water-mill and the same testing apparatus, but the diameter of the water-mill or the length of one or both arms was generally a trifle longer or shorter after an alteration was made, than before, principally because it was not considered necessary to take care to prevent this.

We may add that the water-mill and pump have two arms each, and all the experiments on water-mill were made with the same height of fall formerly mentioned. The jet pieces of pump are the same that were used when the water-mill experiments, the results of which are given in table 3rd, were made. The shape of the cross section of those jet pieces, as also of

the arms of pump, is rectangular, but as the form of each cross section of the arms of water-mill is circular, they were hammered so as to make them change gradually from this to the rectangular shape before the jet pieces of pump were put on the water-mill; that is, when the jet pieces of pump were on water-mill the outermost cross section of each arm was of a rectangular shape, but farther in on the arm, the form of cross section was circular, and betwixt the two points alluded to, the cross section changed gradually from the one to the other form named. As formerly explained, the rest of the experiments on water-mill were made with arms and jet pieces that have the circular form of cross section.

To be continued in the next Number.

THE COMBINED VAPOUR ENGINE.

We have paid another visit to this Engine, the invention of M. Dutrembley, of which we gave a detailed account in our January Number, but we are still unable to give an opinion as to the *degree* of economy which may reasonably be expected from it, in practice. We would be understood as attributing this entirely to the peculiar workmanship of the engine, which does not tend to raise our opinion of French engine-making, and not by any means to a want of facilities, which the responsible parties have liberally afforded us. We ought to mention that the invention has been applied on a much larger scale to an engine driving a factory at Lyons, which would doubtless offer a better opportunity of forming a correct opinion than the example before us.

In the mean time, our attention has been called, by a correspondent zealous for English invention, to a paper in the proceedings of the Royal Institution, published in the Quarterly Journal of Science, Literature, and Art, (January 1830, Colburn & Bentley), which bears so nearly on the question, that we make no apology for quoting the article *in extenso*.

"*February*, 19th.—Mr. Ainger, in a notice on the 'Economy of the Steam Engine,' alluded to the misapprehensions which had at various times existed, as to the saving of fuel which would result from substituting ether or alcohol for water, as the vaporizable material; and he endeavoured to show, that a very simple calculation applied to the known facts, in regard to those substances and their vapours, would have prevented those misapprehensions, and would, indeed, have furnished the same results as have been obtained from experiment. The reasons usually assigned for proposing to use these liquids instead of water, have been the lower temperature at which they assume the state of vapour of a given elastic force (alcohol, for instance, boiling at about 170°, and ether, at about 100°); and, also the smaller latent heats of their vapours, as compared with steam. The boiling point of a liquid, and the latent heat of its vapour, form, however, only a small part of the consideration required for calculating its economy. The cost of a certain quantity of force derived from a given bulk of liquid, depends on the boiling temperature, the specific gravity, and the specific heat of the liquid, and, on the latent heat, the actual weight, and the specific gravity of the vapour. These being known, the relative costs of a certain quantity of power derived from two or more liquids may easily be deduced, as in the following comparison between water, alcohol, and ether.

It may be assumed, that these substances are all supplied to the engineer at the same temperature, say 50°. To raise them to the boiling points, they will require the following additions:

	Boiling Point.
Water	212 — 50 = 162
Alcohol	170 — 50 = 120
Ether	100 — 50 = 50

Multiply these numbers by the specific gravities of the liquids, respectively.

Specific Gravity.
162 × 1000 = 162,000
120 × 800 = 96,000
50 × 740 = 37,000

These results would require to be multiplied by the specific heats of the three liquids; but as the specific heats are not very perfectly ascertained, and, as far as they are known, do not appear to differ very considerably; and, further, as the cost of heating the liquid forms a small part of the whole expense, the specific heats may be safely neglected, leaving the numbers, 162, 96, and 37, to represent the expense of elevating to the boiling temperature equal volumes of water, alcohol, and ether.

The cost of vaporizing them will be given by multiplying the actual weights (represented by their specific gravities) of the three liquids by their latent heats, which are about 1000, 450, and 300.

	Weight.		Latent Heat.		
Water	1000	×	1000	=	1000
Alcohol	800	×	450	=	360
Ether	740	×	300	=	222

Add these numbers to those representing the cost of heating up to the boiling points, respectively:

$$162 + 1000 = 1162 \text{ Water}$$
$$96 + 360 = 456 \text{ Alcohol}$$
$$37 + 222 = 259 \text{ Ether}$$

then the last results will express the whole cost of vaporizing equal bulks of the liquids in question; the advantage, so far, appearing greatly in favour of the ether and alcohol, as compared with water. But it is now necessary to introduce another element into the calculation, namely, the specific gravity of the vapour, or the volumes of vapour produced from equal volumes of liquid. These are nearly as the following numbers:

Water	1700
Alcohol	610
Ether	300

That is to say, one cube inch of water becomes about 1700 inches of steam, at atmospheric pressure; and single cubical inches of alcohol and ether become 610 and 300 inches, at the same pressure. The quantity of power is obviously as the bulk of the vapour, and the cost is of consequence inversely as that bulk. If, therefore, the cost of vaporizing be divided by the bulks of vapour respectively, the quotients will represent the relative expense of equal units of power derived from the three liquids.

$$1162 \div 1700 = .6714 \text{ Water.}$$
$$456 \div 610 = .7475 \text{ Alcohol.}$$
$$259 \div 300 = .8633 \text{ Ether.}$$

From which it appears, that, independently of the original cost of the liquid, supposing, indeed, that alcohol and ether were supplied spontaneously, as accessibly, and at the same temperature as water, even then water would be the most economical source of power.

From this it appears, that the temperature at which a liquid vaporizes, and the quantity of latent heat absorbed in the process, form no criterion of its eligibility for the production of mechanical force; and that, therefore, there is no reason at present to expect that power can be obtained from liquid carbonic acid gas, or any other of the gases liquefied by Mr. Faraday, more cheaply than from water, merely because of the low temperatures at which they become highly elastic. Analogy, it is evident, would lead to a conclusion exactly the reverse, and would induce an expectation that the vapour of mercury, or even of metals vaporizing at a much higher temperature, would furnish the most economical motive power.

Mr. Ainger then described a mode of increasing almost indefinitely the power, or, in other words, of decreasing almost indefinitely the expense of the steam engine, which has not hitherto been suggested, and which appears to require for its realization, only the discovery of a succession of liquids, whose boiling points should differ about 100° of Fahrenheit; whose nature should not alter by repeated distillation; and which should exert no injurious action on the substances composing the machinery of the steam engine. The difficulty of finding such a series of liquids is probably insuperable; if it were not so, there can be little doubt that the cost of steam power would be susceptible of an immense reduction. If, for instance, a succession of liquids could be obtained, whose boiling points were 612°, 512°, 412°, 312°, and 212°, and if the furnace were applied to the first, and its vapour were employed to work a condensing engine, it is clear that the

vapour which was condensed at 612°, could be made to evaporate the second liquid, by condensing the first on the surface of the vessel containing the second, the vapour of which would, in its turn, work a steam-engine. The condensation of the second vapour at 512° might in like manner, evaporate the third liquid which boils at 412°, and so on, till the water which boils at 212° was evaporated, and which might be condensed by injection in the usual way.

It may perhaps be thought that a cooling surface at 512° will not sufficiently reduce the tension of a vapour at 612°, to leave any effectual difference between the pressures on the two sides of the piston; but it must be recollected, that a depression of 100° reduces the elastic force of a vapour produced at 612°, as much as of one produced at 212°. The elastic force of common steam at 112° is equal only to $2\frac{1}{2}$ inches of mercury; the elastic force, therefore, of the vapour produced at 612° would, when cooled to 512°, be also equal only to $2\frac{1}{2}$ inches of mercury. There is it must be confessed, a difficulty in condensing by mere contact with a metallic surface, as compared with condensation by an injection: but this difficulty would, in the proposed case, be much less than in the various schemes which have been projected to use alcohol, ether, and liquid carbonic acid, because in the former it is proposed to cool a less easily vaporized substance by one more easily vaporized; whereas, in the latter case, water, which has been the intended cooling material, is less easily vaporized than the substances it is required to cool; a circumstance obviously unfavourable to the production of the effect. But for this difficulty, it is probable that the heat employed to vaporize water might, by the condensation of the steam, be transferred to alcohol, and from this again to the ether; but the question then arises, how is the heat to be extracted from the ether; we have no other means than the contact of a vessel containing cold water, a means which is found insufficient for cooling common steam, and which would, therefore, be doubly inefficient in cooling the vapour of ether. These considerations will suggest other difficulties in the construction of engines to use alcohol, and ether, beyond the absolute defect of economy, which has been before explained."

From Mr. Ainger's concluding remarks it will be seen that the tubular condenser (Hall's patent) was considered by him "as inefficient for cooling common steam." Experience has shown that this difficulty may be overcome. Whether this will be the case with his other objections, remains to be proved.

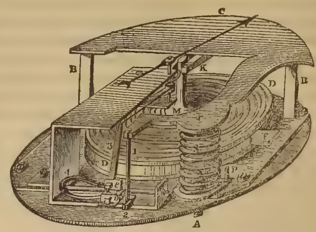
THE ANEROID BAROMETER.

Through the courtesy of our contemporary, *The Literary Gazette*, we are enabled to give a sketch of the details of this ingenious invention.

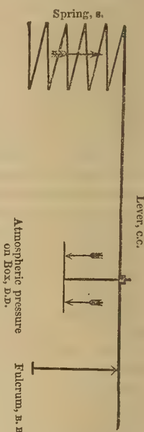
The inconveniences of the ordinary mercurial barometer have been long admitted, and several attempts have been made to obviate the necessity of using a column of mercury, which from its height and liability to derangement, presents many disadvantages, but hitherto without success. In the *Bulletin des Sciences*, Tom. 1, No. 13, p. 106, there is an account of various barometers invented by M. Conté, an ingenious experimental philosopher, who is well known by the chalk crayons, which bear his name. One of these is composed of two segments of spheres, of metal, one being rigid and the other sufficiently flexible to yield to the pressure of the atmosphere, a vacuum being formed between the plates. This was in the year 1798, but as it does not appear that M. Conté succeeded in constructing an accurate instrument like M. Vidi's, to the latter must belong the credit of carrying out the principle.

Fig. 1, (being half size) shows the latest and most improved arrangement of M. Vidi's barometers.

D D is a box of copper, the top of which is corrugated to allow of its rising and falling without injury to its elasticity. The air having been withdrawn from the box by an air-pump, the aperture is soldered up at F to preserve the vacuum. On the top surface is soldered a piece of brass M, at the extremity of which is a pin, acting on the short arm K of the lever C C, which rests upon knife edges at B B, as a fulcrum, and is pressed upwards by the coiled spring S, which prevents the surfaces of the box from collapsing by the atmospheric pressure. The end of the lever C C is connected by a rod No. 1, to a lever No. 2, which is on the same spindle as



lever No. 3, and to the latter is attached a wire and a chain, passing round the spindle on which the hand is fixed. The spindle is also provided with a flat spiral spring, which draws the hand back in one direction, while the atmospheric pressure acting upon the box D D moves it in the opposite direction.



The annexed diagram will perhaps render the arrangement plainer. When the atmospheric pressure on the box D D becomes less, the spring S raises the lever C C, and turns the indicating hand to the left side, as seen by the dial-plate; and when the atmospheric pressure increases, (or presses more on the box D D) the spring in its turn is pressed downward by the lever C C, which turns the hand to the right.

The bow-piece, No. 4, connects the two arms, No. 2 and 3, so that by setting the screws, *e* and *b*, the lengths of the arms can be adjusted to bring the instrument to the same scale of divisions as a standard barometer. The height of the barometer is adjusted by the screw A at the back of the box, which, when screwed or unscrewed, presses or relieves the spring S, and turns the indicating hand. The pin at P is to hold the spring S.

We should be doing an injustice to M. Vidi, were we not to notice the statements which have appeared in the *Athenæum* respecting the means employed in the instrument of compensating for variations of temperature. It was stated in the *Literary Gazette*, on the authority of Mr. Dent, that this is effected by means of a *gas*, which is introduced into the box, after the atmospheric air has been exhausted; "absurdly enough," says the *Athenæum*.

It appears that M. Vidi's first instruments had the sustaining spring *inside* the box, and that a compound bow-piece was used to compensate for the changes of temperature. The present ones, however, are made without a compensation bow-piece, and with the spring *outside* the box, as shown in figure 1.

We cannot say, on our own authority, *how* the compensation is effected, but we have exposed our own Aneroid to a temperature varying from 50° to 100° Fahr. and find that the extreme variation is only one tenth of an inch.

THE CITY OF MANCHESTER SMOKE CONSUMING COMPANY'S APPARATUS.

This Patent has been applied with considerable success to several boilers in Lancashire, and has been severely tested, under various circumstances, at the Royal Dockyard, Chatham.

This plan differs from most others in being entirely independent of any control or attention on the part of the stoker, and may be applied to furnaces which are fed either by hand labor or by machine. It consists of a small fan which carries the smoke from the end of the boiler flue, along a return

flue into the hottest part of the furnace, where the combustible particles are entirely consumed. No cold air is admitted, except through the fire bars, so that the objections which have proved fatal to all schemes on that principle, viz. the wear and tear of the boiler, and the difficulty of regulating the supply of air are, entirely obviated.

We think that a plan of this kind will be found useful in many situations, and we have the less hesitation in giving publicity to the favourable reports we have seen, as the experiments have been carried on under the superintendence of an old member of the Artizan Club, in whose practical and scientific knowledge of the subject we can place the greatest confidence.

CANAL BETWEEN THE ATLANTIC AND PACIFIC OCEANS.

To adventurous minds during the last half century, few subjects have had greater charms than the various projects for opening a communication between the Atlantic and Pacific Oceans. The feasibility of the scheme in a general sense has never been controverted; but as there have been a variety of plans, and each projector has made a point of declaring all to be impracticable except his own, the European public have been deterred from entering into them, while, at the same time, another obstacle has been the constant revolutions in Central America, which have prevented any attempt at permanent negociation with its respective governments.

This state of affairs, however, will now be rapidly changed. There is no one who is not contemplating the mighty alteration about to take place in the old routes of navigation from the events in progress on the northern coast of the Pacific, and it is easy to predict, that during the next few years the rivalry in enterprise between the United States and England, will chiefly be directed to that quarter.

We have already given an outline of the conditions on which the American railway across the Isthmus of Panama is to be constructed, mentioning that in connexion with that scheme it was seen that the ports of the United States might become the depôts of the commerce between Europe and the East; while in the case of a ship canal, the only alteration that would occur would be the shortening of distance for all parties. Still, although this view is taken with regard to the railway by the people of the United States, they are sufficiently alive to the broader considerations connected with a direct junction of the two oceans, and hence simultaneously with the construction of the railroad, there is a strong opinion that no time should be lost in perfecting the larger scheme.

Important, however, as the measure may be to the United States, it is impossible to look at the map, and not perceive that it is far more momentous to England. A railway from the Mississippi, already talked of, would at once furnish an outlet for all the produce of the States to the Eastern seas; but England has no such resource. She must either have a canal through the Isthmus, or make the old passages *viâ* Cape Horn or the Cape of Good Hope, or be content to discharge her cargoes at Chagres, and run up to an American port for a return freight.

Under these circumstances, it may be desirable to put into a compendious form all the information hitherto collected as to the various routes which have been suggested for a canal.

The routes proposed have been five:—1. The Isthmus of Panama in the Republic of New Grenada. 2. The Isthmus of Tehuantepec, at the southern boundary of Mexico. 3. The lakes of Nicaragua, in the Republic of that name; and 4 & 5, two separate channels from the Gulf of Darien. Of these the three first alone require consideration; the routes by the Gulf of Darien having never met with encouragement from any quarter.

First, with regard to the Isthmus of Panama. This Isthmus at its narrowest point is less than twenty miles across, but at this part there is a mountain ridge of 1,000 feet, and it is in the district only between Chagres on the Atlantic and Panama on the Pacific, where the width in a direct line is thirty-three miles, that a passage could be effected. The first grant for the purpose, by the Grenadian Government, was to Charles Biddle, of the United States; but this having lapsed, a new concession was made in 1838, to Salamon and Co., of Panama, a French house, who caused a survey to be made by an engineer, named Morel, and by whom estimates and proposals were subsequently issued for raising the required capital. The terms of the concession were not such as deserved to be entertained. The Grenadian Government were to grant the necessary lands and rights for sixty years; but not only was the canal to be given up to them at the end of that period, but the vessels of the Republic were to enjoy a reduction of 10 per cent. in the tolls charged to other nations, while a tax of 1 per cent. was also to be levied on the annual profits of the company, which tax was to be applied to the dividends on the foreign debt.

The route proposed by Salamon and Co. was one by which the rivers Chagres and Trinidad on the Atlantic side should be united by a canal of twenty-five miles with the river Farfan, which flows into the Rio Grande to the Pacific, the total length of the passage, including the windings of the rivers, being fifty miles, and the highest point of land being thirty-three feet. Building materials, consisting of free-stone, clay, lime and wood, were accessible in abundance. The canal was to be 160 feet in width, and 22 feet deep, and calculated to admit vessels of from 1200 to 1400 tons. It was to be completed in eight years, and the estimated cost was 3,475,000 dollars, or £695,000. The estimate of tonnage likely to pass through yearly was 499,809 tons, and the proposed toll being two dollars per ton, the income would be 999,618 dollars, from which, deducting expenses of 235,000 dollars, a divisible balance would remain of 764,618, or £152,923. The details furnished of this scheme were by no means clear or ample (although the estimate of possible revenue seems not to have been excessive) and other surveyors have represented the difficulties of the work to be far greater. With regard to the harbours on each side, the accounts are favourable, but the surrounding country has no recommendations, and the climate is unquestionably dangerous.

The next route is the Isthmus of Tehuantepec. The direct width of this Isthmus is nearly 150 miles, and a privilege having been granted in 1842 to Don Jose de Garay to construct a canal, he caused it to be surveyed by Signor Moro, an Italian engineer. He proposed to avail himself of the river Coatzacoalcos, the mouth of which had long been pointed out as the fittest place in the Gulf of Mexico for a depôt, owing to its abundance of durable ship timber and the convenience and security of the port. The river through its windings is navigable in some degrees for 160 miles, and after this would come the canal of 50 miles, surmounting in its progress to a table land at a place called Tarifa, 525 feet, and falling from Tarifa to the Pacific 660 feet.

The summit level was to be supplied with water by a trench from two rivers which descend from the mountains to the Pacific. The canal was to be 20 feet deep and 122 feet wide, and would have required 150 locks. Adopting the scale of estimate of the Caledonian canal, the cost would have been £3,400,000.

One great advantage of this route would be the excellence of the country through which it passes.

The salubrity of the climate is said to be unequalled on the American continent, and the population are among the most active and healthy of the Indian races. In addition to a fertile soil, and forests of the finest timber, it is reputed that the mountains contain rich gold and silver mines.

The last and most interesting route is that by the lake of Nicaragua. A proposal for the construction of a Nicaraguan canal was entertained by the King of Holland in 1830, but abandoned, owing probably to the political events of the time. In 1842, however, while a prisoner at Ham, the attention of Prince Louis Napoleon was called to the subject by a communication from a French gentleman at Jamaica, and subsequently receiving a visit from a French naval officer about to start for Central America, the Prince requested him to make observations on the practicability of the communication. The result was the preparation of a pamphlet by the Prince, which was printed in London two years back for private circulation.

From this it appears, that in 1846 the government of Nicaragua conferred full powers on the Prince for the prosecution of the undertaking, and that seeing it "must produce the most beneficial effects on the commerce of all nations," he had resolved to go out and put himself at its head.

The surveys available for the project were those of Mr. Baily, an English engineer, who had been employed by the Nicaraguan Government, but had never been paid for his labour, and of a Mr. Lawrence, of Her Majesty's ship Thunderer, which were made respectively in 1837 and 1840; to

which also are to be added the observations by the French naval captain employed by Prince Napoleon.

On glancing at the map of Central America, the Nicaragua route will at once strike the eye as the most feasible that could be presented, supposing no engineering obstacles to exist of an insurmountable kind, since the river San Juan de Nicaragua runs into the lake, which presents the appearance of a huge natural dock, and which again communicates with the smaller body of water called Lake Leon, separated from the Pacific by a narrow isthmus only, through which a canal of 11 miles, to a river that runs into the sea, would form the termination of the undertaking.

That there are no extraordinary difficulties, the pamphlet of Prince Louis and the authorities he quotes, seem abundantly to testify. It is also plain, that the surveys of this route have been conducted with more practical skill and accuracy of detail than those of the others.

The route commences at the harbour of San Juan de Nicaragua, one of the best on the coast, and which forms the mouth of the river extending from the Atlantic to the lake of Nicaragua. The length of this river is stated by one authority to be 90 English miles, and by another 104. It is described as a magnificent stream, varying in breadth from 100 to 200 yards, with a depth of from one and a half to nine fathoms, studded with islands, and fringed with wood of all sizes and descriptions, and navigable all the year by boats of 8 or 10 tons burthen. Its obstacles are a series of four rapids, which are comprised within an extent of 10 miles; a drainage of certain parts caused by the efflux of its waters into another river, the Colorado, and a labyrinth of small islands amongst the shallows thus created. The largest of the rapids is not more than a mile, and they can all be overcome by locks; the drainage into the Colorado can be remedied by a dam across that river; and the shallow can be got rid of by the ordinary methods of deepening, as the bottom consists of mud or sand. On the whole, the works and deepenings of this river would extend for 33 miles.

Reaching thus the Lake of Nicaragua, the next point of the undertaking is at the river Tipitapa, which connects that lake with the Lake of Leon, since the Lake of Nicaragua, which is 90 miles long, with a mean breadth of 20 miles, has abundant depth, and although studded with fine islands is perfectly free from anything to embarrass navigation. The river Tipitapa is 20 miles in length, and is navigable for boats 12 miles. At one part there is a cascade of 13 feet, and it would require 3 locks, and also that it should be canalized throughout. Arrived at the lake of Leon, which is 35 miles in length, we are only separated from the Pacific by 29 miles, and the highest land above the level of the lake is stated not to exceed 51 feet. Eleven miles from the lake is the river Tosta, with an average width of 65 feet and depth of 6 feet at low water, and it is by cutting a communication to this that the work will be completed, bringing us to the Port of Rialejo.

The total length of this route would be 278 miles (of which only 82 would require works) and amongst its most important recommendatious are its harbours on both sides, the great beauty and variety of its climate, the fertility of its soil, and the extent of its natural productions. During four months, while Mr. Baily was employed with a party of 40 men, not a single individual was prevented from sickness from performing his daily labour, although they were continually sleeping at night in the open air. Provisions of all kinds are abundant. Beef at the rate of 2s. for 25lbs.; maize 16s. for 260 lbs. and rice in the same proportion. The wages of labour, including provisions, average about 9 dollars per man per month.

The proposed depth of the canal was 23 feet, and the width 147 feet, so as to be calculated for merchantmen of 1,200 tons. The dimensions of the locks were to be one-fifth greater than those of the Caledonian canal. The cost calculated on the high scale of the Caledonian canal is estimated at £4,000,000, leaving £400,000 for casual expenses and a reserved fund.

The revenue is taken on 900,000 tons, and as it is calculated that an average of one month would be saved to European vessels, and of two months to United States' vessels, which may be estimated as equal in the former case to 19s. 7d. per ton, and in the latter to 39s., the contemplated toll is 10s. per ton in the one instance, and 20s. in the other. This would give £600.000 a year, which, after leaving 2 per cent. for maintenance and 1 per cent. for sinking fund, would yield a return of 12 per cent. on the capital. The government of Nicaragua, it is also believed, would cede to the company all the land on both sides of the canal throughout its entire course, to the extent of two leagues, forming about 1,200,000 acres, the present value of which would be 1s. 6d. per acre, or £90,000, but which it is contended would be infinitely improved. The estimates of returns in the present case, it will be observed, are higher than those adopted in the project for the Panama canal; but it is probable, looking at the impulse since given to the progress of navigation in this part of the world, that they are not now to be regarded as excessive. At the same time, the difference in the government concession is an important feature in favour of the Nicaragua, as compared with the Panama project.

It may not generally be known that the journey between the two great oceans has already been effected by boat, although the route taken would, for practical purposes, be out of the question. In 1783, a monk pursuaded the Indians to cut a short and shallow canal, which connects the river Atrato, which throws itself into the Gulf of Darien, with the river San Juan, which runs into the Pacific, at about the fourth degree of south latitude.

In the wet season, boats still pass by this route from one ocean to another, but the fact we rather mention as a curious one, than as supposing it to have any importance. The connexion between the two oceans must be on a grander scale than this, and will, no doubt, be shortly effected by one or other of the three great routes we have described.—*Times.*

STEAM NAVIGATION.

WELLS' SIGNALS.—Mr. Wells commenced his experiments on an instrument invented by him for producing shrill sounds by atmospheric pressure, at the South Foreland, on the evening of Monday the 29th of January. It has been arranged that the instrument shall be sounded from six to seven of each evening during this week, and that the tone, and probably the power of the sound, shall be varied every quarter of an hour. Instructions have been given to the persons respectively in charge of the light vessels at the North and South Sand-heads, and the Gull Stream, to observe and note in writing the effect thereby produced as heard by them at those stations. Similar instructions have also been issued to the respective officers, commanding Coast Guard stations in the Deal district. About half-past six on Tuesday evening the sound was distinctly heard at the Newgate station, Margate, by Lieutenant Finemore and his chief boatman, and continued to be heard at intervals at seven o'clock. Wind S.W., fresh breezes, with drizzly rain, but from the density of the atmosphere and the great distance the sound had to travel (which is above 21 miles) the variation of the notes could not be distinguished. The sound appeared very similar to that of a shrill railway whistle as heard in the distance, only perhaps, the notes were still of a shriller nature. The wind being inclined from the North to N.W., on Monday and Wednesday evenings the sound of the instrument was not heard in this quarter. Should Mr. Wells succeed in this his humane invention (which I now think is placed beyond a doubt, having been heard at so great a distance, under such unfavourable circumstances), it will doubtless prove a great blessing to the maritime world, and more especially to those who trade up and down the British Channel, where we so frequently witness the loss of so many lives, and also of valuable property. Should Mr. Wells also succeed in inducing the Trinity to place his instrument on board the North and South Sand-heads and Gull Stream lights, for one winter only, more property would be saved in consequence, than would be required to purchase instruments for producing sounds by atmospheric pressure to be placed in every dangerous position round Great Britain.—*Nautical Standard.*

MEASUREMENT OF VESSELS FOR TONNAGE.—A committee is ordered by the Admiralty to assemble for the purpose of arranging a new plan for measuring the tonnage of ships, the new measurement adopted some 20 years back, having been found so defective. By the correspondence between the Admiralty and Lloyd's, we see that Captain Lord John Hay, one of the Lords of the Admiralty, will be at the head of this committee, and that the assistance of Mr. Creuze formerly one of the members of the late School of Naval Architecture, and now principal surveyor at Lloyd's has been solicited.

Launch of the Floating Railway.—The launch of this vessel for ferrying the train over the Frith of Forth, took place on Tuesday afternoon the 6th ult. at Messrs. R. Napier's ship building yard, near Glasgow. The operation excited considerable interest, more particularly as the vessel was built "broadside," and not in the usual manner with her bow or stern to the river, it being conceived that, owing to the elevation of the ground above the high water level of the Clyde, the launch of the vessel on the broadside system could be more safely and easily effected. The signal being given, the blocks were removed and the stopper ropes cut, when the vessel, 170 feet long on decks by 34 feet wide between the paddles, and 10 feet deep, strongly framed and plated to sustain the great weight of a train of loaded trucks, glided with a gently increasing velocity to the end of the ways, fell about $2\frac{1}{2}$ feet to the river, gave two or three heavy rolls, and then drifted into the centre of the stream, and was towed to the Broomielaw, where she is to receive her machinery. Her engine is 56-inch cylinder, and 3 feet 6 inch stroke, working each paddle. A chimney on each side allows a clear space in the centre for three trucks loaded abreast, and the captain stands above them, between the paddles, to steer either end foremost. This vessel is of iron, ribbed; the plates on the bottom being half an inch thick.

British v. American Ocean Steamers.—A passage across the Atlantic against the strong winds and heavy seas which prevail in the depth of winter is sure to try the strength and sailing capabilities of steamers. Whatever the success in summer, with light and favourable breezes, it is only when the waves are "lashed to storm" that vessels are fairly put upon their trial. The British and North American Royal mail steam-ship Europa, Captain Lott, which sailed from New York on the 10th ult, and Halifax on the 13th, reached the Mersey yesterday morning a little after nine o'clock, making the passage from New York to Liverpool, at this boisterous season of the year, in less than twelve days! This, all things considered, is the most astonishing passage on record. The Europa, on her passage out, left the Mersey on the 16th December, four days after the American steamer, Hermann, sailed from Southampton for New York. The Europa, after making the detour to Halifax, reached New York on the afternoon of the 31st of December, but the Hermann only arrived at Boston (for which port she was compelled to run, being short of coals) on the 4th of January, four days after the Europa reached New York! Again, the American steamer Washington, sailed from Southampton on the 20th of December, and did not reach New York till 19 days after she started. The British and North American steamer, America, which sailed hence on the 30th Dec., reached Halifax on the 10th instant—a very rapid passage, considering the season of the year and the difficulties to contend with. Instances of the superiority of British steam-vessels over those yet built in America now so frequently occur, that we should think that Brother Jonathan was pretty well satisfied that he is no match for Uncle John in this department. We are glad to see a friendly rivalry in these matters, for by it the public are sure to benefit, and talent, skill, and enterprise, meet with their due reward. The public will be gratified to learn that two new vessels, which will surpass all the others in size, splendour, and speed, are about being laid down by the British and North American Company, to replace the Acadia and Britannia, which have been sold.

ROYAL STEAM NAVY.

PROMOTIONS APPOINTMENTS, &c.

First Class Chief Engineer.—R. E. Horne, to the *Janus.*

Second Class Chief Engineer.—J. Johnson, to the *Janus.*

Third Class Chief Engineer.—J. Syder, to the *Janus.*

Assistant Engineer.—James M'Clymont and Charles J. Sergeant to the *Centaur.*

DOCK-YARD INTELLIGENCE.

High-Pressure Marine Engines in the Navy.—The first high-pressure engine introduced into a ship in the navy, is ordered to be fitted to the Minx, iron screw gun vessel, at Woolwich. Her 100 horse-power engines are to be taken out, and high-pressure engines of 10-horse power to be introduced.

Porter's Anchor.—The Admiralty have ordered the exchange of the bower anchors of the Llewellyn steam-packet, respectively of 16 and 17 cwt., of the Admiralty pattern, for two of 12 cwt. each, on Porter's principle. The reduction in weight will afford relief to the bows of the vessel and take off a great superincumbent weight (of serious consequence when contending or pitching in a heavy head sea), while it will be providing her with a better safeguard against dragging, or loss from that cause. After such an acknowledgment as the above of the inferiority of their own anchor to hold a packet, we expect to see a general order issued for the return into store of all the out-hanging old anchors, as, if the Llewellin is unsafe with them, so likewise must be every other vessel or ship provided with them.

Launch of a Small Steam-boat for the Prince of Wales.—On Thursday, the 8th ult, was launched from H. M. Dockyard at Chatham, a small steam-boat named the Elfin; her dimensions are :—

	Feet.	in.
Length between perpendiculars	103	6
Breadth, extreme	14	0
Depth from the bottom of keel, (if a keel it may be called) to the top of deck	7	9
Burden in tons	98·0	

She is of a very light construction, the hull being built of three thicknesses of mahogany boards, each board $\frac{3}{8}$ of an inch thick. The engines are of the collective power of 40 horses on the oscillating cylinder principle, with paddle wheels and tubular boiler by Messrs. Rennie, who, doubtless, will do their best to render this pet-toy (the first cost of which will be about £4,000) as perfect as possible.

Launch of Her Majesty's Screw-Frigate, Vulcan.—On Saturday, the 27th ult., this noble-looking iron ship was launched at Blackwall, and floated handsomely upon the water; indeed we were led to think that "Old Father Thames" must have felt proud of this additional pressure upon his bosom, although we are bound to confess there is much connected with this pleasing fabric that goes "against our stomach," of which we shall reveal a portion. Her dimensions are as follows, viz.: 220 feet length between the perpendiculars; breadth of beam 41 feet; depth in hold, 27 feet; builder's tonnage, $1747\frac{15}{94}$ tons. The calculated weight of the hull only, as launched, 1200 tons (dead weight), add to this 1200 tons more, and she will then be brought down to her constructed load water-line, 17 feet, when fully equipped for sea-service, having the main-deck port 6 feet 9 inches from the water. It may not be generally known to our readers, that the Vulcan is one of three screw steam-frigates ordered, by the late Admiralty, to be built by contract in October, 1845; the other two (one in Scotland and one on the banks of the Thames), are not yet finished. The Vulcan was constructed for engines of 700 horse-power, which were ordered of Messrs. Boulton, Watt, and Co., but when the said vessel was nearly finished, and ready to be set afloat to receive her engines, the present Admiralty took the helm of our naval affairs, and discovered, as is uniformly the case, that their predecessors had made a great mistake, first in adopting iron at all, which was by no means a benefitting material for building ships-of-war; this they speedily and practically demonstrated under the guidance of their sub-surveyor, Mr. Edye, who recommended their lordships to send to Portsmouth an old worn-out "tinpot," place it in mud opposite the Excellent, gunnery-ship, and pepper away at it, with 32-pounders. Never shall we forget the most disgraceful ignorance, exhibited at this period, to give the "death blow" to iron ship-building; numerous nicely finished drawings (coloured portraits) were made and sent to each of my *new* lords and their friends, representing the poor old "tin-pot" as a shattered cullender, perforated in every direction by the inumerable well-directed 32-pounders, fired at it under special directions. They next detected that the engine power ordered for these three ships, was much too great! that it ought not to exceed half the amount (350 horse-power), accordingly the contractors were forthwith desired to suspend their operations until further orders, and ultimately the larger power in each vessel is superseded by the smaller, and the character and object of the three ships entirely changed, the internal fittings removed, decks and engine rooms cut up and altered, and the whole refitted as store or troop-ships, at an immense additional cost, which cost has been further considerably increased by their lordships subjecting the Government to pay the con-

tractor's rent and taxes for the continuance of the ships and engines, upon their premises, for so long a time beyond that which was stipulated for in their contracts. These vessels it appears were to be completed in ten months from date of contract, whereas the hull of one only is just set afloat. It does, indeed, appear to be the first and chief characteristic of each succeeding Admiralty on coming into office, to immediately set about demolishing the work of their predecessors, no matter at what cost. Each of these iron ships have been built from the designs of the contractors, by which there "hangs a very curious tale" concerning one not yet launched, which in due time shall be told.

TESTING ANCHORS AT PORTSMOUTH.—An experiment was made on Saturday 27th ult., under the superintendence of Mr. Owen, the Admiralty inspecter of metals, to ascertain whether the annealing of anchors after their manufacture would render them less brittle and hard, and whether it would not increase their tenacity and make them more tough and fibrous. Shears of about 70 feet in height have been erected in the dockyard, the anchor is hoisted to the top and secured with a slip stopper, the purchase is then cast off, and the anchor hanging "a cockbill" is dropped; it falls on a secure platform at the bottom of the shears, the platform being solid, the top formed of a layer of large pigs of iron-ballast, each of 3 cwt. The anchor is supposed to drop on its crown, the distance from the crown of the anchor to the platform being a fall of about 50 feet. Two large sized anchors were tried to day, both were what are termed, Sir William Parker's, or Admiralty anchors, each weighing 48 cwt., and both similar in every respect except the annealing. The first tried was the anchor in its natural state, as it came from the forge; this was tried twice, and in both cases there was not the slightest damage done to the anchor from the two falls, but each time the pigs of ballast were smashed to pieces. The next trial was with the annealed anchor. This anchor has undergone the process of being heated to a bright red-heat, and in that state covered over with hot bricks and ashes, and thus allowed to cool gradually without exposure to the influence of the atmosphere. Contrary to expectation, this anchor broke on being dropped on the ballast, one of the arms breaking off short close to the broad part of the palm. The fracture exhibited sound and closely-welded iron, but it also appeared too hard and had a brittle and steel-like appearance; the anchor fell on its crown, therefore the fracture was occasioned by the stock and the tendency of the fluke to continue the downward motion. This trial, therefore, as far as it goes, is against the annealing system—but this anchor may not have been properly prepared, this part may perhaps have been cooled (after heating too quickly.) Other trials will follow, and should the annealing be found to render the anchors more tough, and less likely to break, annealing furnaces will be erected in the principal dockyards.—*Nautical Standard.*

ACQUIREMENTS REQUIRED OF ENGINEERS.—The following circular has just been issued for the information of flag officers, captains, and commanding officers of Her Majesty's ships and vessels:—

"Admiralty, Jan. 26th.

"My Lords commissioners of the Admiralty, having, by their circular order of the 1st of April 1847 (No. 32) relative to the examination, pay, &c. of engineers, directed that 'certificates of service in the factory, or proof of acquaintance with engine work,' shall be produced before an assistant-engineer be promoted to the rank of chief engineer; and the attention of my Lords having been called to the difficulties which have been experienced in ascertaining the capabilities and acquirement in respect of those officers who have not served in factories, likewise to the deficiency among the junior grades of engineers (especially of the young men brought up in the service), in that mechanical skill and knowledge so essential to qualify them to undertake the responsible duties of engineers in charge of machinery: my Lords are therefore pleased to direct that a shop be appropriated at Woolwich and one at Portsmouth, under the superintendence of the chief engineer officer of the factories in those dockyards, in order that the engineers, on check, may have the opportunity of acquiring practical skill in the use of such tools as they may be hereupon called upon to use when afloat; and instruction, when necessary, will be afforded by a skilful mechanic who will be selected for the purpose.

"A means will be thus afforded to enable engineers to acquire the requisite mechanical skill, no assistant engineer will in future be advanced to the rank of chief engineer, or to that of first-class assistant, unless he produces a certificate of servitude in a factory, or of his competency as a workman from the engineer officer of Woolwich or Portsmouth Dockyard.

"It is further to be distinctly understood, that in future the periods of service required by the regulations as part of the qualifications of assistant engineers for promotion to the higher classes are to comprehend only the periods an officer may be in receipt of full pay; but on a certificate of good conduct, and of reasonable improvement in mechanical requirements being produced from the chief engineer of one of Her Majesty's factories, half of the time employed in receiving instruction in the workshops will be allowed to reckon as sea time.

"By command of their Lordships,

"H. G. WARD."

There have been during the last 18 months about from 40 to 50 engineers on check at Woolwich Dockyard to whom the above circular would apply, and employment in the manner proposed will prove beneficial to them, and ultimately to the service.

THE DISCHARGED BOILER MAKERS.—Almost the whole of the 50 boiler-makers who have left the factory at Woolwich in consequence of the reduction, have forwarded a memorial to the authorities to obtain a passage to Canada, as they are desirous of becoming settlers in North America. Two of the blacksmiths in the factory department have left voluntarily, being about to sail for the gold diggings in California.

ANALYSIS OF PATENTS.

Frederick William Michael Collins and Alfred Reynolds, both of Charterhouse Square, Middlesex, Engravers and Printers, *for improvements in the art of manufacturing china, earthenware and glass.* Patent dated March 14, 1848.

This invention consists, first, in preparing transfer paper with a composition of six parts by weight of French starch, two parts of gum arabic, and one part of alum. This is applied in one or more coats to ordinary transfer paper, which is smoothed by being passed through rollers. The colours are laid on the paper by one or more blocks, and may then be transferred to the china, &c.

John Coates, of Seedley, Lancashire, calico printer, *for certain improvements in machinery or apparatus for printing calicoes and other surfacee.* Patent dated April 3, 1848.

This invention consists of a method of printing fabrics by a machine adapted to supersede hand labour. The fabric is passed over a printing table, and the printing blocks are brought down upon it by the action of a sliding beam over head. This beam has a printing block at each end, to print two different colours in one pattern, and is moved along to bring the blocks alternately over the colour boxes and the fabric. The patentee claims the arrangement for printing fabrics in one, two, or more colours, by means of blocks or printing surfaces extending the whole width of the goods to be printed, so arranged, that in the event of one or more colours being required, each colour may be printed successively or alternately.

Henry Bessemer, of St. Pancras Road, Middlesex, *for improvements in the manufacture of glass.* Patent dated March 22, 1848.

This first part of this invention consists of improvements in the construction of the furnaces, which at present require to have a number of openings for taking out and replacing the pots. A revolving dome is proposed, with a sand joint to prevent leakage of air, by which one opening suffices for all the pots, which are lifted by a suitable crane. The fire is to be fed with a piston forcing small quantities of coal through a pipe, by which means no cold air is admitted through the fire door. The second part relates to a method of shaping fluid glass by passing it through rollers, on which are sunk the necessary patterns. The third part describes various methods of forming ornamental articles by combining small pieces together by heat, and of applying powdered glass in a similar manner. The fourth part consists in using a bath of fusible metal on which the glass may lie to be annealed, instead of on the ordinary kiln floor, which becomes uneven by use, and throws the plate of glass out of shape. The fifth part consists in applying atmospheric pressure to hold down plates of glass while being polished, instead of cement. The sixth part consists in crushing the grains of the sand to be used in grinding, to make them more efficient, and in separating them according to size, to suit the various stages of the grinding process.

Elizabeth Wallace, of Laurel Lodge, Cheltenham, Gloucester, spinster, *for certain improvements in facing, figuring, designating, decorating, planning, and otherwise fitting up houses and buildings, parts of which are applicable to articles of furniture.* Patent dated Feb. 28, 1848.

The invention consists in employing tablets of glass, behind which ornamental tinsels may be placed, the whole being embedded in plaster of Paris; coloured glass may also be combined for various ornamental purposes.

Theodorus Cornelius Seeger, Knight of the Order of Reiderlauche Lion of St. Gravenhage, Holland, but now of Leicester-square, Middlesex, physician, *for improvements in the construction of railway carriages.* Patent dated March 8th, 1848.

The first part of this invention consists of a method of strengthening the framing of railway carriages by diagonal wood or iron pieces, and the second part, of constructing an independent seat for each traveller, with a door in front, both of which are to be lined with elastic packing, in order to mitigate the effects of a sudden collision.

George Ellins, of Droitwich, Worcestershire, salt manufacturer, *for certain improvements in manufacturing salt, and in apparatus for manufacturing salt.* Patent dated March 22, 1848.

The patentee claims employing currents of hot air, to facilitate evaporation; machinery for raking and drawing the salt out of the brine, in the moulds and frames for drying the salt, and an apparatus for supplying the fuel, but the specification is so tautological in its language, and trivial in its details, as not to warrant any further notice.

Benjamin Gray Babington, of George-street, Hanover-square, Middlesex, M.D. and John Spurgin, of Guildford-street, Middlesex, M.D., *for improvements in the manufacture of metallic pens.* Patent dated March 27, 1848.

The great inconvenience in the use of metallic pens is the rapid oxidation which the points undergo. The patentees propose to attach to the pen a piece of zinc, or any alloy of zinc, which will prevent the oxidation of the nibs from taking place, and the pen will also hold considerably more ink.

James Pilbrow, of Tottenham, Middlesex, engineer, *for certain improvements in propelling, upon railways and canals, and in the apparatus or machinery by which the same is to be accomplished.* Patent dated April 4, 1848.

This patentee proposes to propel carriages or vessels by the action of water kept under pressure in air vessels, the air being condensed by stationary power. A main pipe is to be laid between the rails with branches at suitable distances, from which the water is allowed to flow against the carriage, while it is passing, and thereby propel it.

Thomas John Knowlys, of Heltham Tower, near Lancaster, and William Fillis, of Shirley, Hants, *for improvements in generating, indicating, and applying heat.* Patent dated April 5, 1848.

This invention relates, first to fire-places of fire tiles, with proper ovens, boiler, &c., the fuel burning downward, to consume the smoke. The steam from the boiler is to be employed to drive a wheel to turn the spits, &c. The second part relates to the application of pyrometers of various descriptions, fusible metals, &c. to indicate the temperature of the ovens.

Joseph Foot, of Spital-square, Middlesex, *for improvements in the manufacture of sieves.* Patent dated April 6, 1848.

The patentee claims the employment of nipping rollers to take up the wire-cloth as it is woven, so as to produce meshes of an uniform size, the distance being regulated by a ratchet on one of the rollers. The number of teeth taken by the pall will regulate the size of the mesh, which has hitherto been done merely by the judgment of the workman.

Eugene Ablon, of Panton-street, Haymarket, *for improvements in increasing the draft in chimnies, in locomotive and other engines* Patent dated April 8, 1848.

This invention consists in admitting air into the chimney of a locomotive, a trumpet mouth-pipe leading from the open air, and encircling the end of the blast-pipe. (We think the title of the patent would have been more accurately "for *diminishing*" the draft, &c.—Ed. *Artizan.*)

Thomas Potts, of Birmingham, brass tube manufacturer, *for improvements in the manufacture of tubular flues of locomotive and other steam boilers.* Patent dated April 10, 1848.

The patentee states that those parts of boiler tubes of copper and brass that have been coated with the brazing are found to last the longest, he therefore proposes to line the whole of the tube with "bath metal," composed of three parts copper, two zinc, and 10 oz. of tin to each cwt. of the bath metal. Thin tubes of this metal are to be drawn inside the ordinary tube, the thickness of each being in the proportion of two-thirds of the whole for the lining, and one-third for the external tube. The mandril to be $\frac{1}{16}$ taper, which will leave the tube tapering, the thickest end of which is to be placed next the fire-box.

Thomas Spencer, of Prescott, Lancashire, *for certain improvements in machinery or apparatus for manufacturing pipes and tubes, from clay or other plastic materials, part or parts of which improvements are applicable to the manufacture of hollow earthenware.* Patent dated April 10, 1848.

The patentee claims, first, the application of a direct acting steam pressing machine (like a Nasmyth's steam-hammer) to moulding plastic materials; secondly, the peculiar construction of the dies for forming socket-pipes, the socket being formed prior to the rest of the pipe; thirdly, the apparatus for turning over the pipes, which consists of a swivelling frame, with two plates brought up by set screws, which hold the ends of the pipe, the inside being supported by an inside core; fourthly, the method of forming bends by curved drums and cores; and lastly, the improved kilns, and the method of forming the feet, with or without air-holes, for the admission of draft, whilst being burnt, and in the methods of grinding, turning, and boring earthenware pipes.

John Longworth, of Newton Heath, Lancashire, *for certain improvements in pickers for power looms.* Patent dated April 10, 1848.

This invention relates to the construction of those parts of power looms, called pickers, which are used to impel the shuttle along the slay or shuttle-board; these pickers are usually made of buffalo hide, and slide upon spindles, and are driven by leather straps, called picker bands, attached to the picking lever. From their frequent contact with the shuttle, they are subject to considerable wear, and to diminish this expense, the patentee makes them so that they present two good faces for wear, of such a form as to require less material, and to slide in slots in the shuttle-board, instead of on spindles, by which the wear will be diminished.

James Meacock, of Liverpool, gentleman, *for improvements in preventing and extinguishing fire in vessels, warehouses, and other buildings, parts of which improvements are applicable to ventilation.* Patent dated April 12, 1848.

The first part of this invention relates to means of ventilating ships to prevent the spontaneous combustion of coals, by inserting air-pipes in the hold; the second part to the extinguishing fires in dwellings, by having a suitable pipe in each room, communicating with the street main, by which means a stream of water can be poured into any room by a policeman in the street in case of fire; and thirdly, to the ventilating rooms or cabins by using hollow cornices, to carry off the vitiated air.

Richard Madigan, of Haverstock-hill, Hampstead-road, Middlesex, civil engineer, and John Coope Haddan, of 14, Lincoln's-inn-fields, Middlesex, *for improvements in the manufacture of wheels for railways.* Patent dated April 15, 1848.

This invention has reference, first, to wrought-iron disc wheels, and includes various combinations of the disc and tire by welding and rivetting the parts together; secondly, to various methods of forming wrought-iron spoke-wheels with wrought-iron naves; and thirdly, to forming wheels of cast and wrought iron, by running a thickness of cast iron upon a disc of wrought iron, and by running the cast iron, forming the body of the wheel, against the inner side of the tyre.

Selah Hiler, of New York, in the United States of America, *for improvements in the manufacture of stair-rods.* Patent dated April 15, 1848.

To obviate the inconvenience of persons' feet catching against, and displacing stair-rods, the patentee proposes to make them like a hollow convex lath, to be held down by a button-headed screw; and describes the dies and other means of forming the said laths, as also a buffing-wheel for polishing the same 8

Charle Green and James Newman, of Birmingham, manufacturers, *for improvements in the manufacture of a part or parts of railway wheels.* Patent dated April 15, 1848.

This patent relates to a method of forming and fixing the tyre of wheels. The section of the tyre iron is proposed about double the ordinary width, so that after it has been put on the wheel, the extra portion of tyre may be squeezed down by successive dies, so as to completely embrace both sides of the rim of the wheel.

Thomas Forsyth, of New North-road, Middlesex, engineer, *for improvements in the manufacture of railway wheels.* Patent dated April 15, 1848.

This patentee proposes to form railway wheels of a solid mass of wrought iron, of a disc shape, which is to be mounted on a center, and moulded while hot, by a pair of conical rollers for the disc part, and a suitably moulded roller for the tyre.

William Newton, of Chancery Lane, Middlesex, civil engineer, *for improvements in machinery for burring, ginning, and carding, wool and cotton, or similar fibrous materials, requiring those processes.* Patent dated April 27, 1848.—(Communication.)

The patentee claims first, the mode of making the holding cylinders, by combining a series of toothed rings, of the form described, or series of such teeth, placed in the form of rings on the circumference of a cylinder, with recesses or spaces between the several rings or sets of teeth, and also between the teeth individually, which recesses are sufficiently large to receive the fibres of the wool, or other material, and yet so small as to exclude the burrs and other coarse extraneous matters. Secondly, the method of making the beaters or cleansing cylinder, by composing them of a series of segments of cylinders, arranged round the periphery of a shaft, in lines parallel to the axis, and securing such segments, or series of semi-cylinders, in the manner described, upon an internal cylinder or shaft, so that their outer edges shall project, and at the same time be perfectly true, and parallel to the said shaft.

Michael Joseph John Donlan, of Abbot's, Bromley House, Staffordshire, Esq. *for improved compounds or mixtures to be used for lubricating machinery.* Patent dated April 4, 1848.

The object of this invention is to produce lubricating compounds of better qualities than the raw oils. We will give *part* of one process, which will give our readers a good idea of the amount of twaddle that we have to wade through every month. For compound, No. 1, the patentee takes ½ oz. of the oxymuriate of mercury, ¼ oz. of the sub-nitrate of bismuth, ¼ oz. of tartarized antimony, and having pulverized them, they are to be placed within a Papin's digester, with 4 quarts of hot water, (110° Fahrenheit ;) the mixture is then agitated with a brush for about 3 minutes, allowed to settle, and to remain for an hour in a quiescent state; next is to be added ½ oz. of the sulphate of copper, ¼ oz. of the sulphate of zinc, ¼ oz. of ceruse; the ingredients have then to be agitated for five minutes, after which they are to remain, for about an hour in a quiescent state, as before. The liquid portion is then strained into another Papin's digester, by aid of a linen cloth, leaving the residuum in the first digester; 8 oz. of the green leaves of laurel, and 8 oz. of the green leaves of ivy, are then to be cut into small pieces and pounded in a mortar, adding thereto ½ oz. of Roman alum; the pounded leaves are, along with the pulverised alum, to be next placed within a cylindrical copper vessel of about 10 inches long by 4½ inches in diameter, and having one of its extremities finely perforated, whilst to the other extremity is a ring to which is affixed a light copper chain with a weight attached: the leaves and the Roman alum having been placed within the copper cylinder by aid of a door at the side, and afterwards carefully fastened, the cylinder with its contents is to be submerged within the liquid in the digester, which is to be heated up to 120o Fah., and the heat continued for one hour, and so on *ad infinitum.* Caoutchouc and whale oil are to be combined to finish this scientific process, and marine engines are to be treated with 2 lbs. of black pepper, to assist the *digestion,* we presume !—(Ed. *Artizan.*)

LIST OF ENGLISH PATENTS.

GRANTED FROM 23RD JANUARY, 1849 TO THE 15TH FEBRUARY 1849.

William Henry Barlow, of Derby, civil Engineer, for improvements in the construction of permanent ways for railways. Patent dated January 23rd; six months.

Richard Johnson, of Blackburn, in the county of Lancaster, gentleman, for improvements in the manufacture of malted grain, and in vinous fermentation; also improvements in brewing, and in the machinery or apparatus connected with the above or similar processes. Patent dated January 23rd; six months.

Wakefield Pinn, of the borough of Kingston-upon-Hull, engine and boiler maker, for certain improvements in propelling ships and vessels. Patent dated January 25th; six months.

Robert Shaw, of Portlaw, in the county of Waterford, cotton spinners and Samuel Fletcher Cottam, of Manchester, machinist, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Patent dated January 25th, six months.

John Talbot Tyler, of the firm of Ashmead and Tyler, Mount-street, Grosvenor-square, hatters, for certain improvements in hats, caps, and hat-cases. Patent dated January 25; six months.

William Bogget, of St. Martin's Lane, Middlesex, manufacturer, for improvements in methods and Machinery for obtaining and applying motive power. Patent dated January 20th; six months.

Henry Bernouli Barlow, of Manchester, consulting engineer, for improvements in the manufacture of cut piled fabrics, and in machinery or apparatus applicable thereto. Patent dated January 20th; six months. (Communication.)

Samuel Brown, the younger, of Lambeth, Surrey, engineer for improved apparatus for measuring and registering the flow of liquids, and of substances in a running state, which apparatus are in part also applicable to motive purposes. Patent dated January 20th; six months.

Henry Needham, of Vine-street, Piccadilly, in the city of Westminster, gun maker, for certain improvements in fire arms. Patent dated January 20th; six months.

Thomas Robinson, of Leeds, flax-dresser, for improvements in machinery for breaking, scutching, cutting, heckling, dressing, combing, carding drawing, roving and spinning flax, hemp, tow, wool, silk, and other fibrous substances. Patent dated January 23rd; six months.

Charles de Bergue, of Arthur-street west, in the city of London, engineer for improvements in steam-engines, in pumps, and in springs for railway and other purposes. Patent dated January 23rd; six months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam-engines. Patent dated January 23rd; six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Patent dated January 23rd; six months.

Charles Henri Paris, of Paris, in the republic of France, for improvements in preventing the oxidating of iron. Patent dated January 23rd; six months.—(Communication).

Pierre Frederick Gougy, of Paris, in the republic of France, gentleman, for improvements in apparatus and machinery for lifting and moving heavy bodies, for raising and displacing fluids. Patent dated January 27th; six months.

Richard Archibald Brooman, of Fleet-street, London, for certain improvements in the mannfacture of artificial limbs. Patent dated January 27th: six months.—(Communication.)

James Green Gibson, of Ardwick, near Manchester, machinist, for certain improvements in machines used for preparing to be spun, and spinning, cotton and other fibrous substances; and for prepairing to be woven, and weaving such substances, when spun. Patent dated January 27th; six months.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, for improvements in the manufacture of soap. Patent dated January 30th, six months.

Alexander Wilkings, brewer, and William Stacey, engineer, both of Bradford, in the county of Wilts, for a certain improvement or improvements applicable to the heating and boiling of liquids of any kind or description. Patent dated January 30th; six months.

Samuel Wellman, Wright, of Chalford, in the county of Glouceter, civil engineer, for certain improvements in preparing various fibrous substances, for spinning, and in machinery and apparatus connected therewith. Patent dated January 30th; six months.

William Kenworthy, of Blackburn, in the county of Lancaster, cotton-spinner, for certain improvements in power looms for weaving. Patent dated January 31st; six months.

Henry Bessemer, of Baxter House, Old St. Pancras-road, in the county of Middlesex, engineer, for certain improvements in the manufacture of glass, and in apparatus connected therewith. Patent dated January 31st; six months.

Jean Adolphe Carthron, of Paris, in the Republic of France, now of the Haymarket, in the county of Middlesex, chymist, for cértain improvements, in dyeing. Patent dated February 5th; six months.

John Browne, late of Bond-street, but now of Great Portland-street, Middlesex, gentleman for improvements in constructing and rigging vessels; and improvements in atmospheric and other railways. Patent dated February 6th; six months.

Edmund George Pinchbeck, of Fleet-street in the city of London, for improvements in certain parts of steam-engines. Patent dated February 6th; six months.

Thomas Snowdown, of Noel-street, in the county of Middlesex, engineer, for improvements in machinery for moulding and pressing artificial fuel and bricks. Patent dated February 6th; six months.

Joseph Harrison, of Blackburn, in the county of Lancaster, machine maker, and William Harrison of Blackburn, in the same county, cotton manufacturer, and John Oddie, of Blackburn, assistant manager, for certain improvements in and applicable to looms for weaving. Patent dated February 6th, six months.

Henry Fisher, of Upholland, in the county of Lancaster, gentleman, for improvements in coke ovens, and in machinery and apparatus for working the same, or connected therewith; and a mode or modes for applying certain portions of coke, or the residual products of coke, to heating and lighting. Patent dated February 8th; six months.

Lawrence Hill, junior, of Motherwell Iron Works, near Hamilton, Lanarkshire, civil engineer, for improvements in the manufacture of iron, and in the machinery for producing the same. Patent dated February 8th; six months.

Henry Headly Parish, of Eaton-place, in the county of Middlesex, Esq., for improvements in safety and other lamps, and in gas-burners. Patent dated February 8th; six months.

Richard Pannell Forlong, of Bristol, button manufacturer, for improvements in castors for furniture. Patent dated February 8th; six months.

William Willcock Sleigh, of Stamford Brook House, Chiswick, in the county of Middlesex, doctor of medicine, for a means of preventing injuries to persons and property, from the sudden stoppage of railway-carriages. Patent dated February 8th; six months.

James Webster, of Basford, in the county of Nottingham, engineer, for certain improvements in apparatus for manufacturing gas. Patent dated February 8th; six months.

John Taylor, of Parliament-street, Westminster, architect, for an improved mode for constructing and fencing walls. Patent dated February 8th; six months.

Joseph Barnes, of Church, in the county of Lancaster, for an improved apparatus for bleaching, dying, clearing, and steaming, animal or vegetable fibrous substances, either in a raw or manufactured state. Patent dated February 8th; six months.

Robert Brown, of Saddler's-wells, in the county of Middlesex, engineer, for improvements in machinery for perforating, sewing, stitching, pegging and rivetting. Patent dated Febrmary 8th; six months.

William Tooth, of Broad-street, engineer, for improvements in water-closets, and in chimney-pieces, in machinery for the preparation of clays and other materials and in the manufacture of earthenware articles. Patent dated February 8th; six months.

Thomas Charles Clarkson, of Bennet-street, Southwark, manufacturer, for certain improvements in the manufacture and application of leather and certain vegetable substances to be used in combination with leather, india-rubber, canvas, silk, cotton, wool, and other fibrous substances in the manufac'ure of certain waterproof articles. Patent dated February 8th; six months,

John Giblett, of Trowbridge, the county of Wilts, gentleman, for improvements in the manufacture of woollen cloth. Patent dated February 10th; six months.

George Edmund Donisthorpe, of Leeds, manufacturer, and James Milnes, of Bradford, both in the county of York, for improvements in the apparatus used for stopping steam-engines, and other first movers. Patent dated Feb. ruary 12th; six months.

Jarvis Palmer, of Camberwell, in the county of Surrey, merchant, for improvements in matches, lighters, and similar articles for igniting combustible bodies; in the mode or modes of manufacturing the same, and in machinery applicable therein; also in match and other boxes, and in machinery for manufacturing the same. Patent dated February 12th; six months.

William Harris, of Battersea, in the county of Surrey, shoemaker, for a new or improved mode of preparing leather. Patent dated February 12th; six months.

Wiiliam Brewer, of Malcolm Place, Clapham, in the county of Surrey, and John Smith, of Southville, South-Lambeth, in the county of Surrey, manufacturers, for certain improvements in the manufacture of paper and card-board; and in producing water marks thereon; and also in apparatus and machinery to be used for such purposes. Patent dated February 12th; six months.

Christopher Nickles, of York-road, Lambeth in the county of Surrey, for improvements in the manufacture of woollen and other fabrics. Patent dated February 12th; six months.

Edward Newton, of Chancery-lane, civil engineer, for improvements in engines, and apparatus principally designed for pumping water. Patent dated February 12th; six months.

Matthew Townsends, of Leicester, framework-knitter, and David Moulden, of the same place, framework-knitter, for improvements in machinery for the manufacture of looped fabrics. Patent dated February 13th; six months.

Edward Newton of Chancery-lane, civil engineer, for improvements in machinery for hulling and polishing rice and other grain or seeds. Patent dated February 13th; six months.—(Communication.)

Edward Lord, of Todmarden, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances. Patent dated February 13th; six months.

Achille Chaudois, of Faubourg du Temps, Paris, manufacturing chemist, for improvements in extracting and preparing the colouring matters for orchil. Patent dated February 14th; six months.

William Chambers Day, of Birmingham, in the county of Warwick, iron founder and weighing machine manufacturer, for improvements in machinery for weighing. Patent dated February 14th; six months.

Hugh Lee Patinson, of Washington-house, Gateshead in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or compounds of lead to various useful purposes. Patent dated February 14th; six months.

Richard Ford Sturges, of Birmingham, in the county of Warwick, britannia-ware manufacturer, for improvements in the manufacture of candlesticks, and lamp pillars. Patent dated February 14th; six months.

John Herwood, of Hoxton, in the county of Middlesex, paper-hanging manufacturer, for improvements in the manufacture of paper-hangings. Patent dated February 15th; six months.

PETRIE'S VARIABLE EXPANSION GEAR.

A vast number of schemes have been tried for expansion gear, which have more or less answered the purpose, but we are not aware of any plan which is so completely to the point as Mr. Petrie's.

The ordinary governor, and throttle valve, as we all know, merely wire-draws the steam, when there is a light load on the engine, and accordingly, the governor has been applied to a double beat expansion valve, to cut off the steam sooner, as the load was thrown off. Mr. Petrie has improved upon this by making the governor act upon a supplementary slide, placed inside each D valve, by which means the steam is cut off as close to the cylinder part as possible, and the waste by using the double beat valve, at a distance from the port, is avoided. The accompanying diagram is taken from a card of a 30-horse engine, fitted with this expansion gear, at Messrs. Hargreave's Calico Works, at Broad Oak, Accrington.

The successive gradations show very satisfactorily how the engine has stinted herself of steam, as successive portions of the machinery in the works were thrown off, without any attention on the part of the engine driver. For a factory where the load is of a fluctuating character, we should feel disposed to recommend Mr. Petrie's arrangement in preference to any other with which we are acquainted. We have been promised some additional information on the subject, which we hope to be able to give in our next Number.

DIMENSIONS AND DETAILS OF THE LONDONDERRY AND GLASGOW STEAM NAVIGATION COMPANY'S NEW IRON STEAM VESSEL, "THISTLE."

Built and fitted by Mr. R. Napier, Govan, Glasgow

	Feet.
Length on deck	198·4
Breadth of ditto amidships	26·3
Depth of hold ditto	16
Length of quarter-deck	43·9
Breadth of ditto	27·1
Depth of ditto	1·7
Length of engine-room	60·7

TONNAGE.	Tons.
Hull	$631\frac{27}{100}$
Quarter-deck	$21\frac{88}{100}$
Total	$653\frac{15}{100}$
Engine-room	$276\frac{43}{100}$
Register	$376\frac{72}{100}$

Two side lever engines of 336 horse nominal power.

Diameter of cylinder	$66\frac{3}{4}$ ins.
Length of stroke	5 „ 6
Paddle wheels, diameter extreme	25 „ $9\frac{1}{4}$
Ditto, ditto, effective	25 „ $1\frac{1}{4}$
Length of floats	8 „ $3\frac{1}{2}$
Breadth of ditto	2 „ 2

Three sets of paddle arms, 20 in each. Five floats in the water at 11 feet, draught.

Frames 18 ins. apart at midships, and 24 ins. fore and aft. Plates tapering from $\frac{3}{4}$ to $\frac{3}{8}$ inch.

The *Thistle* was launched on 1st September, 1848, and on her trial trip ran from the Clock Light-house to Cumbray (15·6 miles) in 64 minutes having had to ease twice in that time, on account of the fog. Her average passage between Londonderry and Greenock is 10 hours.

The crew consists of 31 hands. Fifteen seamen, ten in the engine-room, and six in the steward's department.

The *Thistle* has a full female figure-head, no galleries, a square stern, clipper bow, a standing boltsprit, and three masts, schooner rigged, and is commanded by Captain James McKellar, late of the *Shamrock.*

DIMENSIONS AND DETAILS OF THE NEW IRON STEAM VESSEL "MARQUIS OF STAFFORD."

Built by Messrs. John Reid and Co. Port, Glasgow, and fitted with engines and boilers by Messrs. James and George Thompson, Clyde Bank Foundry, Finieston, Glasgow.

	Feet.
Length on deck	173·
Breadth on ditto, amidships	23·
Depth of hold	12·1
Length of quarter-deck	51·8
Breadth of ditto	20·3
Depth of ditto	2·5
Length of engine-room	49·8

TONNAGE.	Tons.
Hull	$336\frac{7}{100}$
Quarter-deck	$28\frac{45}{100}$
Total	$364\frac{52}{100}$
Engine-room	$149\frac{99}{100}$
Register	$214\frac{53}{100}$

One steeple engine of 154 horse nominal power.

Diameter of cylinder	65 ins.
Length of stroke	5 feet.
Feathering paddle wheels, diam. over the floats	22 feet.

	Feet. In.
Length of floats	6 „ 6
Breadth of ditto	3 „ 6
Twelve floats and two sets of rings.	
Two boilers with return flues.	
Length of boilers	18 „ 0
Breadth of ditto	9 „ 4
Height of ditto	8 „ 2
Length of steam chests	6 „ 0
Breadth at bottom	9 „ 4
Ditto, at top	7 „ 6
Height	6 „ 0
Three furnaces in each boiler.	
Length of ditto	7 „ 6
Breadth of ditto	2 „ 6
Height of ditto	5 „ 0

Vessel built with 8 strakes of plates from keel to gunwale, tapering in thickness from $\frac{5}{8}$ to $\frac{6}{16}$ inches. Midship frames $4 \times 3 \times \frac{3}{8}$ inches. Fore and aft frames $3 \times 3 \times \frac{3}{8}$ inches. Distance between frames 2 feet, all through. Keel, stem, and sternpost, $5 \times 2\frac{1}{2}$ inches. Rivets $\frac{3}{4}$ and 1 inch.

The *Marquis of Stafford* was built as Consort to the *Mary Jane* steam vessel, upon the Glasgow and Stornoway, Isle of Lewis and West Highland station, and is the property of the Duke of Sutherland and J. Matheson, Esq. M.P.

On her trial trip, 13th January, 1849, she ran from the Clock Lighthouse to Cumbray in 69 minutes, during a heavy gale of wind, and proved herself an excellent sea-boat; the engine making about 26 revolutions per minute.

The Marquis of Stafford has a male figure-head, no galleries, a round stern, standing boltsprit, and two masts, schooner rigged, and is clinker-built. Commanded by Captain Hudson, late of the *Mary Jane*.—F. B.

BRAZILIAN AND SOUTH AMERICAN MAILS.

Southampton, Thursday, Feb. 22.

We are enabled to state, upon the best authority, that the Lords Commissioners of the Admiralty have accepted the tender made by the Royal Mail Steam Packet Company for conveyance from England of the Brazilian and Rio de la Plata mails. This service is to be performed once a month by means of an independent line of steamers, either from Southampton or Liverpool. The route outwards and homewards is not yet finally determined; but we believe the steamers leaving England will call at Fayal and Madeira, and proceed thence to the Brazilian ports of Para or Maranham and to Pernambuco, Bahia, and Rio de Janeiro. The course of post from the time of departure from, and return to England will probably be about seventy-four days, occupying thirty days outwards and thirty homewards, a fortnight or less being allowed for preparing replies at the Brazilian ports.

The mails to and from Buenos Ayres and Monte Video will be conveyed by a branch line of steamers from Rio Janeiro, in conjunction with the steamers from England, and the course of post to those places will be a month additional.

It is understood that four first-class steamers, of large tonnage and five hundred horse power, will be employed between England and Rio Janeiro, and vessels of a rather smaller class on the branch line from Rio to La Plata. These new vessels will have to be constructed for the Royal Mail Steam-packet Company; and they will be, doubtless, built with such proportions of tonnage to horse power, and according to the latest improvements in the construction of ocean steamers, as will produce sufficient speed, while at the same time accommodations for passengers and capacity for a moderate amount of cargo will be provided. The period for a commencement of the contract is not yet decided upon; it will, of course, in a great measure depend upon the time by which the steam-ships can be got ready to be placed on the station.

The brigs-of-war now employed in the mail service between Falmouth and Brazil will be discontinued as soon as the steam-ships shall have commenced operations. The establishment of a direct steam communication between England and Brazil must be considered as a great national undertaking, and likely to influence very favourably the commerce with South America. Merchants engaged in the Brazil and Rio de la Plata trade will transmit and receive their letters and remittances much quicker, and with greater certainty, than by the sailing packets; at the same time it is satisfactory to know that the contract for performing such service by steamers, with the additional advantage accruing therefrom, will be at a probably less cost to the public serviee than the sum annually devoted to the support of the Falmouth packets.

A few years since a proposal was made to the Admiralty by the Royal Mail Steam-packet Company to convey these mails to Barbadoes, availing themselves of their West India steamers from Southampton as far as that island; they were then to be despatched from Barbadoes by special steamers to the various ports abovenamed. Such a route would, of course, have been more circuitous, and the time occupied by the *detour* to Barbadoes would have caused considerable delay, which will not now be experienced. This proposition was declined, and their lordships have now marked their sense of the important nature of the service by stipulating for a continuous and unbroken line of powerful steamers.

By the existing conveyances to Brazil, the passenger, specie, and cargo traffic is very small. Steam-vessels, like railways, create a traffic where little before existed; and there is no doubt that after the establishment of the line a considerable and progressive revenue will be drawn by the company from these sources.

The Royal Mail Company have the option of selecting either Southampton or Liverpool as the port of departure for the steamers. Southampton seems to possess the most inducements and advantages as a terminus for the line from its contiguity to London, its railway running into the docks alongside the ships; from the favourable position of the port in a geographical point of view in relation to the quickness of approach by vessels from the south; from the nearness of Havre, the Liverpool of France, from which there would be an amount of traffic and business thrown into the Southampton steamers; and, amongst other things, from there being a line of mail steamers from Oporto and Lisbon to Southampton, which would cause a portion of the large business between Portugal and Brazil to be diverted to Southampton and the Peninsula steamers would thereby act as feeders to the Brazilian line, particularly as regards passengers, specie, parcels, and valuable merchandise, both out and home.

We learn from New York that Southampton is to be provided with two lines of American mail steamers from the United States—the one already in existence from New York to Bremen *via* Southampton, performed by the Ocean Steam Navigation Company's ships *Hermann* and *Washington;* the second is to be established by a company just formed, called the Neptune Ocean Steam Company, whose vessels are to run between New York and Harve, calling at Southampton outwards and homewards. The latter association will employ the steam-ship *United States* (which has made several voyages), and the new steamer *Franklin*, of 2,500 tons and 1,000 horse power, now nearly ready for sea. The two companies will, we understand, despatch their respective ships alternately from New York, so that a semi-monthly communication will be kept up. Notwithstanding the misfortunes that have attended the American Ocean steamers between this port and New York, and the accidents to machinery from bad weather and other causes, yet the enterprise has turned out profitable and remunerative to the projectors, from the rich freights the ships invariably carried and the large number of passengers that have generally patronised the line; the Government of the United States and the American Post-office authorities having on all occasions, from patriotic feeling, and from a desire to foster and encourage ocean steam-navigation, declined to put in force the penalties for accidents and detentions, to which by terms of the contract they were entitled. The Navigation Laws of the United States, as at present constituted, afford advantages to the American steamers which the British steam-vessels do not possess. The American steam-ships take out all sorts of foreign merchandise as well as British manufactures on freight. The former can afford to pay a very much larger rate of freight than English goods; but the British steamers can only take the latter to the United States. A modification of the British Navigation Laws, if followed by a corresponding alteration in the American regulations, would act favourably on the British steamers in this respect.

If this port be made the terminus of the Brazilian line of ships, Southampton will possess unbroken mail steam communication with the greater part of the world—say Spain, Portugal, the Mediterranean, Egypt, India and its dependencies, China (and soon Australia), the United States, British and foreign West India Islands, Mexico, South American States, Venezuela, New Granada, Chili, Peru, Bolivia, Brazil, Buenos Ayres, &c.—*Times.*

"We have had many quarrels with you," said a lady once to me in Washington, "but we are proud of our descent from the English. We court the French when it suits our purpose, but, she added with great emphasis, we would not be descended from them on any account.—*The Western World*, by Alexander Mackay.

THE SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Thursday, February 6, 1849.

JOSHUA FIELD, ESQ., President in the Chair.

THE paper read was, a "Description of the Abattoirs of Paris," by Mr. R. B. Grantham, M. Inst. C.E. The Paper commenced by pointing out the advantages resulting from the method in which the butcher's trade was carried on in Paris. It was stated that this trade was regulated by a number of restrictive enactments, and conducted under the control of a Syndicate or Guild, who advised with the Government upon all questions relating to the Abattoirs and Markets.

It appeared from the account, that, previous to the opening of the abattoirs, in 1818, slaughter-houses existed in the crowded and populous districts of the city; and that (as at present in London,) the passage of the cattle through the streets, and the consequent nuisances, were found to be intolerable. The five abattoirs were designed with great care, to obviate these evils, and were generally allowed to have fully accomplished the purposes for which they had been constructed; they had been of great public service in rendering Paris free from those nuisances which were still permitted to exist as blots on the general cleanliness of the City of London.

The abattoirs were erected within the Barriers, opposite Montmartre, Menil-Montant, Grenelle, Du Roule, and Ville Juif, at an average distance of a mile and three quarters from the centre of the city.

The paper, which was accompanied by detailed plans of each abattoir, and a general drawing of their arrangement, described minutely their construction, as well as the mode of slaughtering the cattle, the melting the tallow, and other details connected with the trade carried on therein. All the buildings were stated to be abundantly supplied with water, well ventilated, and kept in the highest state of cleanliness.

Tables were given of the number of cattle, sheep, and pigs killed, and the amount of tallow melted during the last four years; and a statement was appended, from which it appeared that the revenue (derived from tolls, charged upon all the meat killed, at per kilogramme,) amounted during one year to £47,608 16s., that the total expenses were £4,958 12s., leaving a profit to the city of Paris of £42,650 4s., or about 6½ per cent, upon £680,000, the original cost of all these establishments. The paper argued that if this revenue were obtained from the tolls, &c., for slaughtering meat for a population not exceeding one million souls, who did not consume anything like the amount of animal food that Englishmen habitually indulge in, how much greater would be the profit of such establishments for London, where there was a population nearly approaching three millions of souls, in whose behalf such strenuous exertions were now making for the increase of sanitary regulations and more ample supplies of water, and everything tending towards a higher state of cleanliness and health.

In the discussion which ensued, and in which Mr. E. Chadwick, Professor Owen, Messrs. Leslie, May, Allen, Ransome, Elliott, Armstrong, and others, took part, very interesting statistical facts were given, in connection with the present state of the Smithfield Market, and the evils attendant upon the animals being driven through the streets, and then killed in a state of fever, when the blood was in a condition to induce rapid decomposition of the meat, and render it unfit for food. In proof of this, it was stated that, in the summer, quantities of fine meat were frequently obliged to be thrown by the butchers upon the offal heap, within thirty hours from the time of the animal being slaughtered—putrescence being so rapidly induced by the deleterious atmosphere of the slaughter-house pervading the place where the meat was kept.

Among the numerous advantages of a new and spacious establishment like that of Islington Market, to which public slaughter-houses are to be attached, would be the direct contact of the cattle-sellers with the butchers, and, by thus avoiding the intermediate profit of the middle-men, the latter would be enabled to sell their meat in better condition, and at a more reasonable rate, to the public.

The present objectionable system of Smithfield appeared to be upheld merely as a question of revenue to the city, for which the public not only paid heavily, but suffered severely by common annoyance, and by the deleterious effect on public health.

Modifications of the Paris system were shown to be perfectly adapted even to the actual state of the butcher's trade in London; that the internal arrangements of the slaughter-houses would not, in any way, interfere with the employment of the servants of the butchers, nor could any inconvenience arise from their congregating together at such places—nor any loss from theft. All these preventive arrangements had been fully explained by Mr. Grantham, in his recent treatise on public slaughter-houses.

The opinion of the Meeting appeared to be pointedly in favour of so desirable a measure as the establishment of Islington Market; and hopes were expressed strongly, that, by showing to the trade that their interest was so intimately connected with the measure, their co-operation would be obtained to their own ultimate profit, as well as for the public good.

Tuesday, February 13, 1849.

JOSHUA FIELD, Esq., President, in the Chair.

The paper read was "On the Coal-field of South Wales," by Mr. Joshua Richardson, M. Inst. C. E. It commenced by enforcing the necessity for an unbounded supply of fuel for the export trade, the manufactures, and the domestic uses of Great Britain, and enumerating various sources from whence that supply was at present and might be in future obtained; giving at the same time the various and discordant opinions of eminent authorities as to the presumed duration of that supply from the several mineral districts of which the extent was now ascertained. This was variously stated by different authorities at between two hundred years and seventeen hundred years; but Mr. Richardson ventured to assert that, in spite of the increasing demand for home consumption and in augmenting export trade, amounting at present to upwards of six millions of tons annually, when the coal-field of South Wales should be brought into full work, the duration of the supply was beyond calculation. The area of this coal-field alone he estimated, from actual survey, to be one thousand and fifty-five square miles, embracing all qualities, from extremely bituminous coal to pure anthracite. The various veins, and their several thickness, were fully described, with examples of their quality, and analysis of them chemically, with their practical evaporating powers; showing that there existed sixty-four seams or veins of coal, having an aggregate thickness of one hundred and ninety feet. These veins were described to be so situated as to be easily worked by adits or levels, and by pits of slight depth; and thus, the cost at the mouth of the levels varied from two shillings and twopence to three shillings and sixpence per ton—giving a mean of about two shillings and tenpence per ton. The means of transport to the ports of Cardiff, Newport, and Swansea, although at present inefficient, were daily improving, and enabled the coal to be shipped at about the same rates as the coal in the Tyne and the Wear.

The actual annual consumption was shown to be:—

	Tons.
In the Iron Works of South Wales	1,500,000
In the Copper Works	300,000
In the Tin-plate and other Works	200,000
In Agricultural and Domestic uses	1,000,000
In Exports	1,500,000
Total	4,500,000

The useful and evaporative qualities of the various veins were carefully investigated, and it was shown, in a table of relative evaporative values, that

1 lb. of Welsh Coal will evaporate ...	9 lbs. of water.
1 lb. of Newcastle and Yorkshire Coal .	7½ „
1 lb. of Lancashire Coal	7 „
1 lb. of Scotch Coal	6 „

And it followed, that if

Welsh Coal was worth...	20s. per ton.
Newcastle and Yorkshire was worth ...	16s. 8d. „
Lancashire	15s. 6½d. „
Scotch	13s. 4d. „

The coals of Staffordshire and Derbyshire were not taken into consideration, because they were used chiefly for the consumption by home manufactures.

From these, and other statements, and from extracts from Sir Henry De La Beche and Dr. Lyon Playfair's able Report on Steam-coal for the navy—which a succinct abstract cannot embrace—it was shown, that the Welsh coal excelled all others for steam purposes, and for almost all uses to which it was applied; and that, when all other sources of supply had diminished, or had failed, the prosperity of the manufactures and the commerce of Great Britain might be maintained for ages by the coal-field of South Wales.

A very animated discussion ensued, in which several eminent engineers and chemists reasoned upon the statements in the paper, and the contested questions of the evaporative powers of different fuels.

Tuesday, February 20th, 1849.

Joshua Field, Esq., President, in the Chair.

The Paper read was "On the explosion of Fire-damp which occurred in the Eaglesbush or Eskyn Colliery, Neath, South Wales, on the 29th of March, 1848," by Joshua Richardson, M. Inst. C. E.

This paper first detailed the frequency of these occurrences in some parts of South Wales, and more particularly in this colliery, where the tender and friable nature of the coal peculiarly induced in the working or excavation, the formation of fire-damp and explosive gas. This has been shown experimentally by Sir Humphrey Davy, when on breaking up large coal under water he collected a quantity of fire-damp at the surface.

It then gave a description of the colliery workings; the state of the mine before the explosion occurred; the condition in which it was found at the time of the inspection—a fortnight after the accident; the probable cause of the catastrophe, and the best known means of preventing a recurrence of such events.

The seam of coal was described as being about four feet in thickness, of a highly bituminous and friable nature, and worked by an inclined adit or entrance, with a main gallery, whence the stalls were worked on either side—horses being employed to draw out the coal in trams, which were conveyed direct to the vessels in which it was shipped for exportation to the amount of thirty thousand tons annually. The ventilation was effected by a down-cast and an up-cast shaft, between which an air course was arranged so as to extend throughout the active workings, with à chimney at the exit, through which the air should have been expedited by a furnace, which, however, had been rarely lighted; and the air course, which was one mile and five furlongs in length, was in places of unequal and inadequate areas, so that, in certain states of the external atmosphere, the air in the mine became very sluggish, and even at times oscillated to and fro instead of regularly travelling onwards in an uninterrupted current. This was so much the case, that the colliers employed fans to drive the gas from them into the proper channels. Great negligence appeared to have existed, both in the general system of working, and in the use of Davy lamps, which were frequently used without the wire gauze guards.

The usual state of the mine could not be judged by inspection *after* an accident, as all the falls and incumbrances had been removed, the destroyed doors and stoppings had been well replaced, and general precautions had been adopted, which evidently had not previously existed; but there still remained evidences of want of precautionary measures. Candles and open lamps had been constantly used, although the general fiery character of the mine was notorious; and, after the explosion, two Davy lamps were found without their wire-gauze guards.

The temperature in various parts of tho mine was so near that of the external atmosphere, that it was evident spontaneous ventilation could not have proceeded regularly; and it was shown, that the slightest change of the density of the air even from the sun breaking out, would have sufficed to render stagnant the whole system of ventilation; especially as the furnace, which should have accelerated the current by exhaustion, had been allowed to fall into a ruinous condition, and had seldom been used, and the velocity of the current had rarely exceeded five feet per second, which was totally inadequate to supply the requisite quantity of air for such an extent of workings

The cause of the accident was, therefore, very apparent, and might be attributed to a want of a general good system of ventilation, permitting accumulations of gas and fire-damp, and the careless use of open lights, or unserviceable Davy lamps; and the consequence of this was the sudden death of twenty men, and several horses, with great injury to the mine.

The means of prevention were, evidently, a complete revision of the system of ventilation—the enlarging of the air coarse, to uniform and adequate dimensions— the proper division of the air into several columns—the construction of proper doors and stoppings in convenient positions—strict regulations for the use of Davy lamps, or other means of lighting, and better general superintendance, by educated men, who would enforce precautionary measures.

Due credit was given to the proprietors for their anxiety to afford every means of inspection, and for adopting all suggestions calculated to prevent the recurrences of such an event; and it was stated that they had since erected one of Mr. Price Struve's ventilating apparatus, of the working of which an account was promised in a future communication.

In the discussion which ensued, the various systems of working and of ventilation, in all parts of England, were noticed,; and it was shown that, in general, every means was adopted to prevent accidents; but that up to the present time, the mines in the West were not as well managed as those in the North, or the midland district. Every day, however, introduced better measures and better men, of education, for carrying into effect the most approved systems, and that as the mines became more extensively worked, so these accidents would and did become less frequent.

The paper announced to be read at the meeting of Tuesday, February 27th, was "On fire-proof buildings," by Mr. J. Broadwood, Assoc. Inst. C. E.

INSTITUTION OF CIVIL ENGINEERS OF IRELAND.

Tuesday, 13th February.

At the meeting of this Institution, Mr. William Purdon, civil engineer, read a most interesting account of the Woodhead Tunnel, on the line of railway between Manchester and Sheffield.

The situation and character of this extraordinary work was described by Mr. Purdon, who acted as resident engineer throughout its construction, and was thus enabled to give accurate plans and diagrams for the illustration of the paper. An enlarged section of the ridge of mountain that was pierced, showed at a glance the nature of the structure, and how the design and lines of the work stood related to its geology and physical character. The highest point of the ridge is 1,552 feet over the sea, and 620 feet above the tunnel formation. The length of the tunnel is 3 miles and 15 yards, and there is 79 feet difference of level between one end and the other, with an uniform inclination of one foot in 200 between these limits. In consequence of the great depth from the surface to the level of the tunnel it was calculated that but little time in proportion to the expense would be gained by sinking many shafts in addition to opening each entrance face, so that but five shafts were sunk. The average depth of the shafts is 515 feet. They were sunk at 16 feet to one side of the range of tunnel, and so disposed over its length as to bring all the faces of operation to a termination at one period of time.

The setting out of the line of the shafts, and transferring the range and levels into the interior of the hill, was a practical performance of some nicety and consequence, which was detailed with circumstantial minuteness; after which the paper proceeded with an account of the preliminary operations and various opinions regarding the mode of construction that should be employed. Two driftways six feet square were driven, one at the bottom of the tunnel and the other at the crown, throughout the entire length, which was attended with some advantages. The diameters of the shafts were 10 feet, and a 25-horse steam-engine was applied at the top of each to work the pumps, and wind out the excavated material. The ventilation of the works was provided for by an ingenious application of two furnaces to rarify the air in the upper driftway, and permit an escape by the flue of a chimney, whilst fresh air was drawn in by the bottom driftway to supply its place; and in some stretches of the tunnel air was blown in by a fan-wheel, driven with great speed by the engine, and communicated by means of square wooden pipes.

The drainage of the works was effected by cast-iron pumps of nine

inches bore, and divided into three lifts at each shaft, the manner of working which was illustrated. The lifting out such a quantity of water as was met from so great a depth, engaged the principal power of the engines. The details of the arrangement of the pumping apparatus were fully explained.

The process of sinking the shafts, and the manner of lining them with masonry and timber, were then gone into, after which a description of the winding gear for drawing up the excavated material was given. The time occupied in sinking the various shafts varied. They were all commenced at end of 1839, and the three that were situated more easterly were gotten down in little over two years. The two western shafts were attended with less success, in consequence of the difficulties encountered from an extraordinary quantity of water that was met at a great depth, and accounted for by the geological formations, as it afterwards appeared; they occupied about four years in sinking. When the power of the engines was insufficient to pump out the water, resort was had to coffering the shaft through some heavily watered beds of strata that had impervious layers at top and bottom, by which means the lifting it out by the pumps was obviated. The various difficulties and ordinary casualties that arose in the course of sinking, under the circumstances, required prompt and well considered efforts to meet them on every occasion, or defeat would have resulted. Putting aside certain exceptional delays, the rate of sinking was two yards a week. The quantity of water drawn out of the shafts whilst they were in progress of sinking was 2,388,246 tons weight, and after they were sunk to the bottom the quantity of water drawn up was 3,374,511 tons weight; the total quantity was 5,762,757, tons, which would fill a cubical cistern of 197 yards square. It was estimated that this immense quantity of water was lifted through a vertical space of 350 feet, a work equal to the labour of 58 horses for 4½ years. The water that was continually passing away at the lower end of the tunnel, after it was completed, was by means of two open side drains 12 inches wide and 5 inches deep, with a velocity of 3.4 feet per second, which indicated a discharge of 1,064 gallons per minute.

SOCIETY OF ARTS, ADELPHI.

January 31, 1849.

W. TOOKE, Esq. F.R.S. in the Chair.

W. Windsor, E. Waller, L. Bunn, W. Cory, J. Jennings, B. T. Vivian, F. W. C. Clothier, A. Warren, L. Roughton, Esqs. and Mrs. Holtzapffel, were elected members.

Robert Hunt, Esq., read a paper by A. Claudet, Esq., on the Photographometer for measuring the intensity of the chemical action of the rays of light on all photographic preparations, and for affording a means of comparing the sensitiveness of the same. The paper was illustrated by specimens and diagrams.

The art of Photography, observes the author, is founded on the property with which light is endowed, namely, that of producing a photographic effect when it strikes upon certain chemical compounds. The effect being in proportion to the intensity of the light during a given space of time, it is necessary for the success of the operation, to be able to ascertain the exact power of the light at any particular moment, and the only means of so doing hitherto possessed by the Photographer, is the effect it produces on the eye. A few only of the rays which emanate from the sun are capable af producing on the chemically prepared surface, an effect which is the cause of the Photographic picture, and if it were possible, to admit into a room only the rays which are endowed with the power of effecting the Photogenic preparation, the objects in the room would not be visible to the eye, as the room would appear to be plunged in darkness, while the objects in it would reflect some invisible rays which are capable of producing the Photographic image.

This fact the author illustrated by a series of specimens in which the effects of rays of light were reflected from the various colours used on porcelain.

The property of absorption possessed by red, orange, yellow, and green glass, being known to the Photographers, and the power of admitting through blue glass nearly all the Photogenic rays which are not luminous, combined with the improvements which have taken place since the discovery of the art by Daguerre, enable the Photographist of the present time to employ a very soft light, and to place the sitter in the shade.

The action of the blue and yellow rays was shown by covering a large print one half with dark blue, and the other half with yellow glass, that portion of the print which was visible to the eye through the yellow glass, was rendered invisible by the action of the ray on the photographic plate, while the ray reflected from the blue glass which entirely obscured the picture, was rendered perfectly clear and distinct. Several specimens intended to show that the luminous and Photogenic rays are not the same were also exhibited.

Several philosophers are of opinion that the Photogenic rays are as independent of the light as heat is, although they are sent forth from the same source, and travel together at the same velocity, and are subject to the same laws of reflection, refraction, and polarization. The actinic or photogenic rays are situated at the most refrangible part of the prismatic spectrum, and are thus refracted to the same degree as the blue indigo or violet rays. A series of experiments on various colours obtained by artificial means were next exhibited, the whole tending to prove that the atmosphere of London with its smoke and fog, is too often for the Photographer like the ray from the yellow glass.

As the result of the Photographic operation depends on the intensity of the actinic rays, and also upon the degree of the sensitiveness of the chemical preparation, Mr. Claudet has constructed an apparatus which is not only capable of measuring the Photogenic light, but of testing the sensitiveness of the chemical preparation of the Daguerreotype plate. This instrument is constructed so that a plate being placed upon an inclined plane will always fall with the same rapidity for each operation; the plate has seven vertical slits or openings cut in it, these are placed parallel to each other, the first being one millometer wide; the second 2 millometers; the third 4; the fourth 8; the fifth 16; the sixth 32; and the seventh 64 millometers. The Photogenic surface is placed at nearly the bottom of the inclined plane under a metallic plate pierced with seven circular holes corresponding with the openings of the moveable plate containing the proportionate apertures. When the moveable plate passes before the photogenic surface covered with the seven circular holes, the light strikes upon the spaces left open by the circular holes in various intensities. The space lighted by the opening of 64 millometers will be affected by an intensity double that which is lighted by 32, will quadruple that of the next under the opening of 16, and so on until the last opening, which being only one millometer, will have received 64 times less light than the first, so that after the operation, seven round figures or less according to the intensity of light, are represented upon the photogenic plate. The Photographer is thus enabled to ascertain how long it will be necessary to submit the plate to the action of the light on the Camera by the length of time required to develope the seven round figures. Let us suppose that he wants ten seconds, it would prove that the light is one half less, and he finds only six instead of seven of the round figures; it would prove that the light is one half less intense than he required, he must be 20 seconds instead of 10; if only five, he must be 40 seconds, if four, 80 seconds, if three, 160 seconds, if two, 320 seconds, if one, 640 seconds. This is quite sufficient for general purposes of Photography; but for scientific investigations, Mr. Claudet has continued the geometrical progression, and instead of from 1 to 6, he has continued the progression from 1 to 8,192; this is effected by having two plates and four series of holes in each plate, and shutting one series after every fall of the moveable plate. By repeating the falls, the intensity is doubled, trebled, and quadrupled, and so on, and after the operation, each plate represents four series of round figures, showing the various effects of all the intensities from 1 to 8,192. Mr. Claudet's Photographometer enables the operator to compare the sensitiveness of two different preparations, so that the Photographer can constantly, by experiments, improve the sensitiveness of the surface.

In illustration of the action of the photographic ray on finely polished surfaces, Mr. Claudet exhibited a series of photographic specimens which had been impressed without the use of mercury, and at the conclusion of the paper, Mr. Robert Hunt, in reply to a question by Mr. Webster, stated, that although it is necessary, to insure rapidity of action, that some chemical compound, as iodide or brom-iodide of silver, should be employed, yet we have distinct evidence that everybody in nature is liable to change under the influence of sunshine. This is easily capable of proof. If a perforated screen is placed upon a glass, metal, or stone plate, and it be then exposed

for an hour to sunshine, all those parts which are uncovered will be found to be in a different condition from those protected by the screen; and if the tablet be submitted to the vapour of mercury, or even if we breathe over it, a deposit will take place upon some parts, and not at all on others, leaving a distinct outline of the perforated image. If a plate covered with resin is employed, that portion of the resin which is exposed to solar radiation is rendered more soluble than the other covered portion, and may be with greater facility dissolved off. In any of these instances, however, we may also convince ourselves that all bodies have the power of restoring themselves in the dark to that condition in which they were previously to the disturbing influence of the sunshine;—realising the hypothesis of Niepcè, that the hours of darkness are as necessary to the inorganic world as night is to the organic creation.

Referring to the term "actinism," which Mr. Hunt explained he had adopted after Sir John Herschel had proposed to class all photographic experiments under the term of actino-chemistry, he proceeded to state, that every day brought additional evidence that light and this actinism, the chemical agent which always accompanies it, are not identical; that where we have indeed the most light, there we have the least actinic power. By employing an absorbent yellow medium, and allowing the prismatic spectrum to pass through it, and fall upon some highly sensitive photographic preparation, on which at the same time the full light of the sun is reflected from a mirror, a space is preserved over the line marked by the coloured spectrum absolutely free from change; while every other part will be blackened, this line will remain white, thus showing that light is in direct antagonism to the actinic solar radiations.

Mr. T. B. Jordan gave a short account of Mr. Cochrane's machine for sawing timbers with curved and bevelled faces, and a working model was exhibited to the meeting.

The thanks of the Society were presented to Mr. Hunt, Mr. Claudet, and Mr. Jordan, for their communications.

February 7, 1849.

Dr. Roget in the Chair.

W. Atkinson, W. S. Hale, and T. Ivory, Esqs. were elected members.

Mr. E. Highton, C.E., read the second part of a paper on improvements in Electric Telegraphs, and new plans for printing by electricity. After a brief recapitulation of the various instruments described in the former part of this paper, the author proceeded with his investigations of the remaining part of the subject.

The peculiar effects produced by arranging a series of galvanic batteries in various order were noticed, as also an arrangement for producing what the author called the "Electrical Paradox." In this arrangement it was shown that the power from a battery, however large the area of the plates of that battery was, might be entirely stopped or the current even reversed by another battery so small, that it would pass through the eye of a needle. Cells for batteries composed of common green glass were exhibited, and were stated to be economical and efficient.

With respect to batteries, Mr. Highton expressed his approbation of those consisting of zinc and copper and the salts of ammonia.

The author then alluded to the rapid oxidation of the railings in the streets of London, which is due to the galvanic action going on in the little battery at the foot of each rail, where the hole in the stone forms the cell and the rail with the lead with which it is fastened, the necessary elements, which are set in action by the water deposited in the hollow.

Mr. Highton then exhibited the gold-leaf telegraph, and remarked on the very small amount of electricity required to work it—not more than $\frac{1}{76}$ of that required for the needle instrument.

It was exhibited at work by the electricity developed by the heat of a burning taper, in reference to which, Mr. Highton expressed a hope that the use of batteries would be eventually superseded by the employment of the heat of a gas burner. It was observed, that the gold-leaf telegraph was selected by the commissioners appointed by the government of Baden to report on the kind of telegraph best suited for the use of that government, and that its practical use in Germany during the last year and a half, had been entirely unsatisfactory. (A detailed account with drawings of this description of telegraph will be found in the *Artizan* for 1846, p. 239.)

The next subject treated of was the line wires, and the law which governs the transmission of the electrical current through them, was analysed. The evils arising from imperfect insulation, and the method of measuring the amount of leakage, were described. The decomposition of water offers a ready method of testing the leakage along a line of wires, either by the decomposition and reformation of water, the difference in the quantities of which shows the amount of electric force lost, or, by two sets of apparatus for decomposing only, one being worked by the direct application of the electric current, and the other by the same current after passing through the line of wires.

The influence of lightning and the aurora borealis on the electric telegraph, in several instances, were noticed, and specimens exhibited of the coils of wire which had been melted by the passage of large quantities of electricity through them.

THE GAS MONOPOLY.

ARE THE CITIZENS OF LONDON TO HAVE BETTER GAS, AND MORE OF IT, FOR LESS MONEY?

A DIALOGUE between, CHARLES PEARSON, Esq., M.P., and a GAS CONSUMER of the City.

We are heartily glad to see that this subject is being taken up in earnest, but the giant Monoply has been so long in possession of his fortress, that we have no doubt he will fight hard for it. A few extracts will be the best commentary :—

"*G. C.* As the Companies have peremptorily refused to lower their rates, and have (as I perceive Mr. Deputy Harrison, one of the Commissioners of Sewers, terms it,) bolted and barred the door against all negociation, what do you recommend the consumers to do?

C. P. I recommed them to do as old Æsop recommended the waggoner to do, to leave off praying to Hercules for aid, to put their own shoulders to the wheel, and you may depend upon it they will soon get their *gas waggon out of the monopoly quagmire.*

G. C. How is this to be done?

C. P. By forming a Company comprised of consumers for the supply of the City alone; in fact, there is a Company already in progress of formation who have a Bill in Parliament to effect this object. When they gave their Parliamentary Notices, the Commissioners of Sewers had a Bill also in the House; this Company's Bill was (as I mentioned in my Report it ought to be) intended as an auxiliary to the Commisioner's Bill if they went on; and as a substitute for it, if they relinquished it. The Commissioners have withdrawn their Bill, and now is the time for the consumers vigorously to push theirs.

G. C. But what security have the citizens that this Company will not do as others have done, lay down their pipes by the side of the existing Companies' pipes, and then join in the monopoly, and charge the same price as their rivals?

C. P. The citizens will have a double security; in the first place the consumers will elect their own Directors to take care of their own interests, and in the second place, the promoters of the Bill have fixed the *maximum* charge at 4s., and offer to introduce a clause that, when the improvement in the quality of the gas and the reduction of price have increased the consumption, so as to increase the amount of profits beyond a ten per cent. dividend, the price to the consumer is to be reduced to 3s. 6d., and probably ultimately to 3s. per thousand.

G. C. I see it is asserted in some of the pamphlets which have been circulated by the Gas companies, that gas cannot be produced at so low a rate as 4s.; and the price of gas in the country, and the market price of the shares in existing Companies, is quoted to support this assertion.

C. P. I should think a single glance at the map I have shown you will sufficiently explain how gas may be charged 6s. in the metropolis, and the shares of the Company be at a very low figure, when such an enormous amount of capital has been buried in the streets, to carry on the fierce competitions which have at various times prevailed amongst the London Companies; and as to the provincial Companies, it is notorious that in most towns the consumption per mile of pipe is less that even in the suburban districts of the metropolis. The fair way of considering this question is, to inquire what are the profits of the Company which supplies the consumers in the City, where they actually pay tens of pounds, or hundreds of pounds a-piece for gas furnished from a single pipe, and not what the Companies pay, that supply a thinly-populated district (say Vauxhall-road, Westminster, for instance), where there are three Companies to share slender profits from a scattered population of consumers. At the recent trial of an appeal of a City Gas Company, witnesses were in Court to support the parochial rates charged on profits, who were ready to prove that the market price of the City Company's shares has been for a series of years, before the recent panic, THREE HUNDRED POUNDS upon shares on which £80 have been paid; and that that price, though very large, was fully justified by the fact, that besides an annual dividend of £10 per share, the proprietors receive large bonuses, amounting, with the dividends, during the last seven years, to nearly £100 per share. This statement of facts affords no evidence of the amount the Company MIGHT pay to their shareholders, if they were animated only by a commercial spirit to make the most of their monopoly and pay the largest possible dividends. The Company conduct their operations with great liberality, and it is said that they have a large reserved fund to provide against an attack upon their monopoly, or any other possible contingency.

G. C. This is to the credit of the Company, rather than their disparagement.

C. P. I have not written, either in my Report or otherwise, a single word disrespectful either of the Company or their management. They have had for twenty-seven years the benefit of a close monopoly, and they have done as you and I should have done—they have kept it to themselves—and they will do as perhaps you and I should do—strive to maintain it: the Companies have a right to get 6s. a thousand from the consumers, if the consumers choose to pay it; and the consumers on their part, have an equal right to get gas for 3s. 6d. or 4s. if they can obtain it.

G. C. But what evidence have you that gas can be produced and supplied at 4s. per thousand cubic feet?

C. P. I have the evidence of my own knowledge and experience, after many years of study and investigation. I have also the proofs which competent judges have given me; and I had a tender, before I reported to the Court of Sewers, from an extensive gas proprietor, to enter into a contract to manufacture the article at 2s. the thousand cubic feet, which would of course, at 4s., leave 2s. for the cost of distribution and payment of dividend on capital.

G. C. Have you any objection to name the gentleman you refer to?

C. P. Not at all. It is Mr. A. Angus Croll, who is what the Americans call a "self-made man;" he has been for several years extensively engaged as an experimental and manufacturing chemist, a gas engineer and superintendent, and a considerable proprietor of gas works; you may form some estimate of Mr. Croll's capacity to arrive at sound conclusions upon the matter in hand, by the manner in which he managed the gas works at Coventry. Previously to 1844 the Company had for four years paid no dividend upon their capital of £20,000, although they charged 10s. per thousand for their gas, with a discount of 1s. to large consumers. Mr. Croll took a lease of the works from the Company for ten years, at a minimum rent of £1500 per annum, to be increased as the gas rental (then £3400) increased, at the rate of 45 per cent. on the gross increase of gas rental. Mr. Croll immediately remodelled the works at an expense of only £1800, and he subsequently re-arranged the rates of charge so as to ensure an average reduction to the consumers of from 33 to 50 per cent. The gas rental increased upwards of 50 per cent.; but such was the effect of increased production under good management, that although the selling price was reduced and the rent of premises increased—each year showed a considerable addition to Mr. Croll's profits, and the shares of the Company, which, before he took possession, were sold at £9, rose immediately afterwards to the par price of £25.

G. C. But it is said in the pamphlets I have referred to, that country gas works afford no criterion to judge of the price of gas in London, because they say that the price of coals in the country is much cheaper than in London.

C. P. That is a complete fallacy, the cost of coals is but a small element in the cost of gas. In London a ton of coals produces upon an average a chaldron of coke, which, with the other residuary products of manufacture, brings a return nearly equal to the cost of coals, less the quantity consumed in carbonizing, which, by recent improvements in the arrangement of the retorts, is being daily diminished in amount. This cannot be said of the manufacture of gas at Coventry and many other provincial towns. At Coventry the gas coals are fetched from a distance of thirty miles, and cost as much or more than the same description of coals in the London Market; whereas the coke does not realize half the price of London coke, as it has to meet competition with a low-priced coal got in the immediate neighbourhood, which is used for the ordinary purposes of consumption, though it would not do to be carbonized for the manufacture of gas.

The Tottenham Gas-works, were erected and managed by Mr. Croll, and have since been purchased of that gentleman by the Tottenham and Edmonton Gas Company; the experience of these works afford some means of ascertaining the price at which the London consumers may be supplied at a profit, as the price of coals and the residuary products at Tottenham may be taken to be the same as in the City.

I am a Proprietor in the Tottenham Company. About a year ago, while the establishment was under Mr. Croll's management, I inspected the works and examined the accounts of purchases and sales, together with the working charges and balance-sheet. The capital of the Company is £15,000: they have laid down thirteen miles of pipes, and erected extensive works, which, with an additional outlay ofabout £3000 would be equal to the supply of five times the present consumption. The rental for the last year was only £1700 for the gas, at an average charge of 6s. per thousand feet. The charges of management amount to £270 for the year; yet, notwithstanding the disadvantages of a large capital invested in works and pipes, with a very small annual gas rental, the Company pay out of profits six per cent. per ann.; leaving exactly 2s. per thousand cubic feet for cost of gas, every description of charge included.

G. C. Certainly, as you say, if the Tottenham Company, which must buy their coals and sell their coke and other products at the same market as a London Company, can manufacture the article at 2s. per thousand cubic feet, there can be no reason why the proposed Consumer's Company should not do the same, as the consumption of the City must be a hundred times as great as Tottenham can possibly require; and if that is the case, what do the promoters of the Consumers' Company calculate the rental and the profits for supplying the City?

C. P. They estimate the minimum consumption of the City as equivalent to an annual rental of £120,000 at 4s. per thousand; taking the cost of the gas at 2s., as at Tottenham Works, it leaves exactly one-half of this sum, or £60,000, to meet dividends on capital, cost of management, and all contingent expenses. It is proved by calculation, that at the present price of iron and building materials, a capital of £250,000 will be ample to produce and distribute a larger quantity of gas than this calculation assumes. In that case, £25,000 per annum will suffice for dividends at 10 per cent.; and if you take £15,000 per annum for costs of management, Directors' fees, and other contingencies, and £10,000 for a reserved fund to provide for depreciation of capital and renewal of plant, &c., the rental would still leave a balance to be applied in further reduction of price to the consumer.

Of the sufficiency of the proposed capital, I believe there can be no manner of doubt. I am, you may say, but a very insufficient judge of such matters, but I have repeatedly consulted with those who do understand them, and who have had no motive to mislead me, and they assure me that the stated capital is adequate to all the purposes required. The enormous capital expended by other Companies can afford no test of the amount which the Consumers' Company would require. A very great reduction in the price of iron and other articles has taken place in the last few years; and it must be recollected that a large outlay has been

incurred in past years on the part of all the Companies in experiments, which, although costly to the experimentalists, have many of them been productive of improvements, that enable the manufacturers of the present day to erect their works upon principles of economy and efficiency utterly unknown in monopoly times.

G. C. All this sounds very well, Mr. Pearson, and I dare say it would look very well upon paper; but upon what ground do the Consumers' Company fancy that they will have all the supply of the City—which I suppose the calculation of £120,000 a-year rental assumes? Do you imagine that these wealthy Companies will stand by and allow a new Company to wrest from them their income, after an enjoyment of so many years? It must not be forgotten that the capital of the old Companies is either invested in bricks and mortar, or buried in the ground, and it cannot be withdrawn or applied to any other purpose. If the new Company lay down their pipes, they must not expect to run away with all the custom. If the new Company sell for 4s., don't you think the old Company will sell at 3s. 6d. The mysterious aggregation of individuals called "the public" are not celebrated for a romantic spirit of grateful generosity. Don't you think it likely Mr. Pearson, that the public would composedly look on, while the new and old Companies, engaged in a sort of Dutch auction, might underbid each other until the reserve fund of the old Company would swallow up the new one?

C. P. I thank you for the hint; it is not the first time I have heard it thrown out; but I must say that, without ascribing to the public the romantic feeling of generosity to which you have referred, I think a sense of justice would induce the great mass of the gas consumers in the City to deal with a fair Company at a fair price. It should be recollected that between four and five thousand of the consumers of the City, numbering among them the very first houses, have signed petitions in favour of a new Company; and I do not believe, for the sake of 6d. a thousand, or for any other consideration, that they would be induced to turn their backs upon a Company called into existence under their own auspices at a time when the old Companies, who had for so many years basked in the sunshine of their favour, had refused to move with the times, by lessening the weight of a burden which presses with peculiar severity upon the commercial and trading portion of the community. But, independent of the opinion which I entertain of the feeling of justice that pervades the public mind, the prospectus of the Company appeals to the *interests* as well as the *feelings* of gas consumers; it not only invites them to become shareholders to the extent of 75 per cent. upon the subscribed capital, but the promoters positively declare that, unless the consumers' portion of the shares be taken up BY THAT CLASS, their omission will be taken as an intimation that they do not desire to join the Company in a manner which could alone warrant its formation.

G. C. Certainly, if the consumers take the share, the new company will be safe enough. It is said that the commercial spirit of the Dutch once led them, when besieged, to sell gunpowder to replenish the besiegers' exhausted magazine, John Bull is made of different stuff; it is hardly likely that consumers, if shareholders in the new company, would deal with their opponents to their own detriment, in order that they might save sixpence a thousand in the price of gas.

C. P. There is a case which I am informed is exactly in point to prove your opinion just. The old Gas Company at Plymouth charged a very high price for gas—I think it was 10s.—the consumers not being able to bring them to reason, formed a company to supply themselves at a greatly reduced rate. New works were established, and the consumers took their own gas, notwithstanding the old company made a reduction considerably below the new company's price. The consumers remained firm in their position. The old company having in vain tried to get back their old customers, or to procure new ones at the reduced price, gave up the contest, and sold their works to the new company, who, during the whole of the conflict, had been enabled to pay their shareholders a fair dividend on the capital employed in the undertaking.

It may, however, be incidently remarked that a new company might start in the race of competition, even against the old companies, with many advantages on its side. New works would be erected in the most approved form to ensure both economy and working power. A new company would have no dead weight of expensive staff to carry, and all their arrangements would be conducted under the management of a directory chosen by the shareholders, stimulated to economy by the additional pressure of competition.

G. C. Although I grant a reduction of 33 per cent. in an article of so much importance to a tradesman as gas, is a matter of serious moment; yet some drawback should be allowed for the inconvenience and injury to business, which will result from opening the streets for the reception of another set of pipes.

C. P. I dwelt at some length upon this part of the question in my Report to the Commissioners of Sewers; but I find, by subsequent inquiry, that my apprehensions upon this point had considerably magnified the amount of inconvenience which may, in fact, be almost entirely avoided by good management and a little extra expence. Mr. Croll assures me that he would bind himself to lay the pipes throughout the City between the hours of seven at night and eight in the morning, closing the ground and replacing the pavement as he proceeds, so as not to give the slightest interruption to either carriage or foot passenger during the entire day. He further states he would undertake to commence and conclude the work during the six summer months.

G. C. This would undoubtedly remove almost the only serious objection which has pressed upon my mind."

Our readers must not imagine that, because Mr. Croll's name appears so prominently, that gentleman's proposals to supply the City with gas are unsupported by experience. Messrs. Alfred Toy, and Co. are now supplying the Eastern Counties Railway Company at 3s. 6d. per 1000 feet, the service extending over a very considerable distance compared with the City. We believe that, in this case, the company have power to purchase the works if at any time they should consider that the contractors are making too large a profit—a point which we recommend to the consideration of all proposed Gas Companies, as affording a guarantee for economy and efficiency in their works.

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(Continued from page 43).

CARPENTER.

All timber used in this building of foreign growth must (if required) be delivered whole on the premises prior to its being sawn into scantlings, for the inspection of the architect, or his clerk of the works. The whole of the timber (excepting where it is specified to be oak) is to be sound yellow *Memel, Riga*, or *Dantzic* fir timber, free from sap, shakes, and loose or large knots. The oak timber is to be English growth, sound, and well-seasoned, cut die square, and free from sap or other defects. The deals to be the best yellow *Christiana*, sound, hearty and clean.

Perform all the carpenter's work shown in the drawings and herein described, and also all carpenter's work necessary to complete other trades and the intended buildings.

Roofs.

Lloyd's Commercial Rooms.—Span roof, with rising ridge and two small hips east end; plate 8 in. by 6 all round; six framed principals, cast iron corbels, tie-beams 13 in. by 8, oak queens out of 10 in. by 8, principals 10 in by 8, straining beams 11 in. by 8, braces 8 inches by 6; all to have straining sills 8 in. by 4, and three of the principals to have two extra braces each. Two 1-inch bolts to feet of principals; three trusses to have inch suspending bolts; the oak queens to have stirrups 78 inches long, 2½ in. by ½, with keys and wedges. Pole-plates 12 in. by 7½; four tier of purlins 10 in. by 5; return plate 10 feet long, 5 in. by 4½, notched to pole-

plates at angles, and two tier of plates or templates 5 in. by 4½ for purlins; ridges 8 in. by 2, hips 11 in. by 2. The north and south gutters 18 in. wide, principally parallel, but the highest parts partly on slope. The small gutters as shown. Blockings to purlins, straps 4 feet long, 2 in. by ½, to hold in pole-plates to tie-beams.

Roof over Subscription Room, Lobby, and North-West portion of Captains' Room.—To be a span roof hipped, with return, six hips and one valley. Wall-plate on all walls. Provide for 14 iron socket-beams (28 lbs. each) on small templates as to second floor. Eight framed principals to lie east and west, with iron corbels and iron bolts and stirrups; two of them, *i. e.* those at the north and south ends, to be stronger, the timbers being 10 inches instead of 8. All these trusses to have the extra braces and straining sill. Two semi-trusses at each end; the timbers the same scantling in depth as the other trusses, and 8 inches thick. One oak queen to each, and the straining beams framed into the oak queens of the main trusses, and bolted to them with inch bolts 2 ft. 6 long. Iron corbels, bolts, and stirrups to these trusses as to the others, and four cast-iron saddles to receive the ends to weigh 84 lbs. each, bolted to main tie-beams, each with two 1-inch bolts 13 inches long, and one tie-beam bolted to the other with inch bolts 3 feet long, with strap ends and staples.

Two king-post trusses across captains' room; tie-beams 9 in. by 4; principals 8 in. by 4; oak king-post out of 7 in. by 4; ¾ bolts to principals; stirrup to kings 4 ft. 6 by 2 in. by ⅜; valley 10 in. by 4; inch boarding to vallies 6 in. wide.

Lloyd's Reading-Room.—Two queen-post trusses to lie east and west; tie-beam 13 in. by 10, oak queens out of 14 in. by 10, principals 10 in. by 10, straining beams 11 in. by 10, braces 10 in. by 5; two middle braces 10 in. by 7, stirrups 72 in. by 2½ by ½; 1¼ bolts to principals; 2-inch suspending bolts 87 in. long; cast-iron corbels as before. Six semi-trusses to lie north and south; tie-beams 10 in. by 4, principals 9 in. by 4, braces 4 in. by 4; six iron saddles 56 lbs., and two 13-inch ¾ bolts to each; two inch bolts to each of these principals; pole-plate 6 in. by 4, purlins 9 in. by 4, wall-plate 7 in. by 5½; fourteen cast-iron bearers 28 lbs. each.

Small Roof each side of Tower.—Two king-post trusses to each; tie-beams 9 in. by 5, oak king-post 8 in. by 5, principals 7 in. by 5; ¾ bolts to principals; stirrups 40 in. by 1½ by ½, wall-plate 6 in. by 4½, pole-plate 6 in. by 4, ridge 8 in. by 2, hips 11 in. by 2, purlin 9 in. by 4.

Roof over Bar and part of Captains' Room.—Wall-plate 6 in. by 4½, three king-post trusses, tie-beams 10 in. by 5, principals 8 in. by 5, oak-king out of 9 in. by 5, braces 5 in. by 4, inch bolts to principals, stirrups 56 in. by 2 by ½, pole-plate 6 in. by 4, one tier of purlins 9 in. by 5, ridge 8 in. by 2, hips 11 in. by 2.

Lead Flat over Staircase.—Six fir flitches 12 in. by 3, bolted with inch bolts 3 ft. 6 apart; no wall-plate; bridgings 10 in. by 2½, gutter south side, 12 in. wide; rolls as to other flats.

Lead Flat over Captains' Room.—Six fir flitches, and bolts as before to iron beams; circular framed plate 10 in. by 3½; plate on south side only, 6 in. by 4½; bridgings 10 in. by 2½; ten iron beams 28 lbs. each, to carry framed plate.

London Assurance: Upper Roofs.

East Roof and Flats.—Plate all round 6 in. by 4½, part circular; eighteen iron bearers, 28 lbs. each; seven king-post trusses; the tie beams to vary in length, the principals and king-posts all equal; tie-beams 12 in. by 6, principals 8 in. by 6, oak kings out of 10 in. by 6, stirrups 56 in. by 2 by ½; inch bolts to principals; braces 6 in. by 4, pole-plate 12 in. by 6, one purlin 9 in. by 4½; fourteen iron ties 4 ft. by 2 in. by ½; fir flitch 12 in. by 3, bolted to east side of iron beam with inch bolts 3 ft. 6 apart; bridgings 8 in. by 2½; plate for ends of purlins 5 in. by 4½.

West Roof.—Plate all round and on cross wall 6 in. by 4½; four king-post trusses, tie-beams 9 in. by 4, principals 7 in. by 4, oak king-post out of 7 in. by 4, braces 4 in. by 3, stirrups 40 in. by 1½ by ½; three-quarter bolts to principals; one tier of purlins 8 in. by 5, plates for ditto 5 in. by 4½. pole-plate 6 in. by 4.

Royal-Exchange Assurance: Small Upper Roofs.—Five-inch upright curbs against lower roof and flats, framed like the partitions, one pair, and allow 200 feet lineal of filleting 1¼ in. by 1, to adapt them for slating; plate all round 6 in. by 4½, level with and framed to heads of curbs; eight bearers, 28 lbs. each. Four king-post trusses over luncheon-room, one over kitchen, and six over the long roof; tie-beams 9 in. by 4, principals 7 in. by 4, braces 4 in. by 3, oak kings out of 7 in. by 4, three-quarter bolts to principals; stirrups 48 in. by 1½ by ½; one tier of purlins 8 in. by 4½, pole-plate 6 in. by 4, blockings 4 in. by 2½, 12 inches apart under it on slated curbs; valley 10 in. by 4. The curb to be continued on gables.

Portico and Building behind: Great Span Roof.—Six fir flitches 14 in. by 7, bolted with 1½-inch bolts 3 ft. 6 apart. Fir flitches to all the eleven iron beams except the two short beams, 12 in. by 4, bolted with 1¼-inch bolts 3 ft. 6 apart. Eleven tier of raking binders under slope 10 in by 4. Plates to all walls 9 in. by 6, bridgings 7 in. by 2½, 1½-inch boarding for lead 2½-inch rounded rolls.

Span Roof over Court Room of Royal-Exchange Assurance.—Plate all round 8 in. by 6; three king-post trusses; tie-beams 11 in. by 6; principals 9 in. by 6; oak kings out of 10 in. by 6; braces 6 in. by 5; inch bolts to principals; stirrups to kings 6 ft. by 2 in. by ½; four tier of purlins 9 in. by 5; pole plate 6 in. by 4½; ridge 9 in. by 2; all other things as to other roofs and gutters; plates for purlins 5 in. by 4½.

Lead Flat and Small Flat at South-east Angle.—The bridgings are already described with floors—everything according to general particular.

Two Span Roofs over Principal Offices of the London Assurance.—Plate and templates as last; three king-post principals to west roof, and three king-post principals and two semi-principals to the other; scantlings and iron work as the last; two king-posts will be out of 10 in. by 8, to allow extra butments, and provide two cast-iron saddles and bolts as before provided; one tier of purlins to hipped roof; two tier of purlins 9 in. by 5, and plates for the same 5 in. by 4½ to the other; pole-plate 6 in. by 4; two pole-plates blocked up with blockings 6 in. by 3, thirty inches apart, and fix eight iron ties to hold them 4 ft. by 2 in. by ½. All other things similar to other roofs. Form trough under floor, 9 in. by 6 inside, of 1½-in. deal tongued, and allow 2 feet cube fir to trim floor for it; the floor over to be ledged as a flap, and screwed down; rough sunk oak curb, 4 in. by 3, for skylight, on blockings, 4 in. by 2½, 12 in. apart, and 20 in. long. To form bracketting round opening, lined above flat with inch deal.

Span Roof and Flat, North-west Angle, over the one-pair offices of the unappropriated set.—Bridgings of flats are taken; girder from A to B, 14 in. by 14, sawn, reversed, and bolted with inch bolts, 3 ft. 6 apart. Wall plate all round span roof; four cast-iron bearers, 28 lbs. each. Three king-post trusses, like the last described. Two tier of purlins, 9 in. by 5; plates 5 in. by 4½ for the same; pole-plate 6 in. by 4; six iron ties for the same 48 in. by 2 by ½; everything else as before described. Oak curb and blocking to elliptical skylight.

The quantity of fir timber to be used in forming hoppers for skylights in roofs is to be 205 ft., including in this quantity that which is elsewhere already described.

All tie beams to be each in one piece of timber; and generally to all the carpentry. All timbers required to be fixed, and which do not exceed 35 feet in length, to be in one piece.

Ceiling Floors under Roofs.

Royal-Exchange Assurance, Court Room.—Five binders, 9 in. by 3, to lie north and south. Ceiling joists, 4 in. by 2; fifteen 1-inch bolts, 20 in. long.

Nine Rooms, Lobbies, and Landings.—Ceiling joists, 4 in. by 2 to the whole; allow 100 ft. cube for binders, and 10 cwt. of iron bolts and straps. Trim ceiling joists, with trimmers, 4 in. by 3, for five opening in ceiling floor, and allow 25 ft. cube for quartering to hoppers to the same from skylights.

London Assurance: Five Rooms, Water-Closet, and Passage.—Ceiling joists to the whole, 4 in. by 2. Four tier of binders to part, to lie east and west; and four tier of binders to the remainder, to lie north and south, 9 in. by 3; twenty-six 1-inch bolts 20 in. long.

Nine Upper Rooms, Staircase, and Passage.—Three tier of binders, some rooms, and four tier of binders, 9 in. by 3, to the remainder. Ceiling joists 4 in. by 2. Forty-five 1-inch bolts 20 in. long. Trim with trimmers 4 in. by 3, to eleven openings in ceiling floor, and allow, in addition, 50 ft. cube for quartering to hoppers from skylight to the same.

Unappropriated Offices, One-Pair.—Ceiling joists to the whole (except the parts covered with joists and bridgings), 4 in. by 2. Four binders, to lie north and south, under span roof, 9 in. by 2, and sixteen 1-inch bolts, 20 in. long. Allow 30 ft. cube for binders, and 2 cwt. of bolts and straps for ceilings of court and committee rooms.

Second Floor.—Three binders, 7 in. by 3, and ceiling joists, 4 in. by 2 to the porters' rooms.

The contractor is to provide, frame, and fix 1000 cubic feet of fir timber, more than is shown or described elsewhere, in extra work to the roofs, flats, and ceiling floors, which the architect may order to be done.

The contractor to provide, frame, and fix 300 cubic feet of fir in extra beams and struts which the architect may order to be applied, in and about the roof and ceilings of the great west portico, more than is shown or described elsewhere.

The contractor to provide fir, and frame and fix ceiling floors to Lloyd's rooms, beyond what is shown or has been described, to the extent of 700 feet cube of timber, according to directions which will be given by the architect.

The contractor to fix all extra iron work connected with this work, to the extent of 65 cwt.

Generally to the carpentry of roofs, and also to other carpentry where it applies: Scarfed joints, and inch bolts to all the larger plates of roofs. Plates in all cases to be carried round all roofs and flats. Common rafters generally to be 4 in. by 2½. All roofs for slating to be boarded with inch yellow deal boarding, edges shot, and the boarding thicknessed. All hips and ridges to have 3-inch rounded holes, and proper irons. All trimming rafters for skylights and dormers 5 in by 3. Featheredge tilting fillets to all eaves and rakes, and round all skylights and dormers. All lead flats to be covered with 1¼-inch yellow boarding laid in half-deal widths, jointed and thicknessed and cleaned off, and to be raised to slopes where required with strong firrings blocked up. Fix 2-inch round rolls for lead to all flats. The gutters to be laid with 1½-inch deal, laid in half-board widths, jointed, thicknessed, and cleaned off. To be laid, unless otherwise shown, with a fall of ¼-inch to each lineal foot, with 2-inch drips, 10 feet apart, carefully rebated for lead. The cesspools to be of 1½-inch deal dove-tailed, with hole cut and dished for socket-pipe, and generally cut all rebates, drips, and holes, and fix all fillets, firrings, and blockings required by Plumber and Slater. To fix to eaves of great span roof a deal moulded trough gutter, with moulded cornice, containing 2 feet superficial of moulding, and 10 inches of gutter board and bearers in each lineal foot, to be carried by oak brackets, 3 ft. by 6 by 4, fixed and wedged in, 4 ft. apart. All joists and timbers to have as much bearing as circumstances will admit, and all timbers to be notched down, and to have solid bearings of their whole depth; the notches of the principal timbers to be dove-tailed. All timbers to be strongly spiked down, and principal timbers to be secured with strong oak or iron pins. No timbers of any kind which are to be boarded or plastered are to be more than 12 inches asunder; all timbers to be trimmed when needful, and all trimmers, and all timbers into which they are trimmed, to be 1 inch thicker than the respective adjoining timbers, excepting where they are described to be more than this.

Carpenter's Work to Floors.

Basement Story.—To lay oak joists 5 by 3, and oak sleepers 4 by 3, to all water-closets, to the kitchen in north-west angle, and to the three rooms south-west angle.

Ground Story.—Frame a floor to great office in south-west angle with three flitches 10 in. by 3, bolted to iron beams with 1-inch bolts 3 ft. 6 apart, and joists 11 in. by 2½; two tier of wall-plates 4½ in. by 4½, to lie on offsets. Frame a floor to the Banking-house offices with six tier of plates 4½ by 4½, in bank, and bridgings 6 in. by 2½, and with joists 11 in. by 2½ in private rooms, with similar plates to lie on offsets; the trimmers to kitchen windows 4 in. thick, oak joists and plates to floors of urinals and water-closets in retiring-room adjoining to Lloyd's staircase, as to water-closets in basement story.

Frame single floors to the nine shops on south side, with joists 11 in. by 2½, notched and spiked to plates 4½ by 4½. Lay similar joists and plates to the four shops in the two circular corners, and fix in addition a circular trimmer, 12 in. by 4, against circular walls, to receive the ends of the joists to be carried by 16 cast iron bearers to weigh 28lbs. each. Lay similar joists and plates to the eight shops in east front, and also to the eleven shops on the north side. Lay joists 11 in. by 2½, to lie east and west, and plates 4½ in. by 4½, to private rooms of Banking-house, north-west angle, and trim them with trimmers four inches thick to kitchen window below. To lay all other parts not paved in this Banking-house with bridgings 6 in. by 2½, and six tier of plates 4½ in. by 4½. Frame floors to the six shops in east area with joists 8 in. by 2½, and plates on offsets 4½ in. by 4½. Lay under flooring of urinals and water-closets in Lloyd's retiring room, oak plates and joists as described for floors in basement story. All the joists deeper than six inches in this floor to have strong double herring-bone strutting, not more than six feet apart.

Mezzanine.—Frame a floor to Royal Exchange Assurance offices, plates 4½ in. by 4½ to lie on offsets on north and south walls to receive ends of joists; all the plates in this story, unless otherwise described, to lie on similar offsets to be prepared by Bricklayer, No.   flitches 10 in. by 3, bolted to iron with inch bolts 3 ft. 6 apart; bridgings 9 in. by 2½ in treasury and water-closet; joists 11 in. by 2½ in accountant's room; ceiling joists 4 by 2 in office under treasury.

The nine rooms over shops on south sides to have joists 11 in. by 2½, trimmed for staircases and slabs of stoves, and plates 4½ by 4½ on set offices. The four rooms in north-east and south-east angle to have similar joists and plates; three joists in each room 3½ in. thick, and circular trimmer adjoining to outer wall 11 in. by 4, to be carried by eight cast iron sockets to each angle.

The rooms over the shops of east façade to have similar framed floors.

The rooms over the shops in east area to have similar framed floors, but the joists to be 8 in. by 2½.

The floors to water-closets and urinals in retiring-room adjoining Lloyd's staircase to have oak joists and plates, like the water-closets on the basement story.

The rooms over the eleven shops in north façade to have framed floors like those on the south side.

Frame a floor to rooms over banking-house in north-west angle, with four flitches 10 in. by 3, bolted to iron beams, with inch bolts 3 ft. 6 apart; bridgings 9 in. by 2½; joists to front rooms 12 in. by 2½; four tier of plates 4½ in. by 4½; ceiling floor to banking-room under. Five binders 7 in. by 3; 10 iron shoes for ditto; ceiling joists 4 in. by 2. Frame a floor to water-closet with two plates 4 by 2½ and joists 9 in. by 2½. All the joists and bridgings of the mezzanine floor to have stout double herring-bone strutting not more than 6 ft. apart.

One-Pair Floor.—Frame a floor to three rooms and passages on the west side of Royal-Exchange Assurance offices, with six flitches, 10 in. by 3, bolted to iron beams with inch bolts 3 ft. 6 apart, and bridgings 11 in. by 2½; the joists to secretary's room 12 in. by 2½, plates 6 in. by 4½ on edge, and provide 28 cast iron shoes to carry them. Lay plates 4 in. by 3, and bridgings 6 in. by 2½ to the whole of the remainder of these offices, the plates not more than 5 ft. apart. Frame ceiling floor to the treasury under, with binders 5 ft. apart, 8 in. by 3, and ceiling joists 4 in. by 2, and provide 14 more iron shoes for binders.

The whole of the remainder of the one-pair floor to have bridgings, 6 in. by 2½, and plates 4 in. by 3, 5 ft. apart. Fix strong herring-bone strutting to all the deep joists and bridgings of this floor, not more than 6 feet apart.

Second Story.—Frame floors and flats level with floors, as follows:—

Single framed floors and flats to nine rooms, two flats, and passages of

the Royal-Exchange Assurance rooms in south-west angle. Plates all round, partly on walls, and offsets, and 30 cast iron shoes, 6 in. by 4½, to carry them. Joists and bridgings 12 in. by 2½; the trimmers to be here 4 inches thick.

The upper rooms of the London Assurance offices to have similar framed floors, including 40 bearers and trimmers 12 in. by 4.

The upper rooms connected with Lloyd's, including room in tower, to have similar framed floors, including 44 iron shoes or bearers, and similar trimmers.

The upper rooms and flats on the same level of the unappropriated offices in the north-west angle to have similar framed floors, with trimmers 12 in. by 4; 20 cast iron shoes.

Circular trimmers and plates to the circular angles of the building.

All joists and bridgings on this story to have strong double herring-bone strutting, not more than 6 feet asunder in any part.

Generally provide 500 feet cube of fir timber, and all labour of framing in extra floors and extra timbers to the floors already described.

Tower.—Frame three upper floors with girders, joists, and plates, and lay them with 1½-inch jointed and rough planed floors of yellow deal; trim them for openings, and form flaps with curbs, linings, hinges, bolts, and other ironmongery; and provide and fix step-ladders and stages, with guard rails and newels; all to be done according to directions to be given, and to the extent in value of £72 at prime cost rate of price; and also three doors, frames, fittings, and ironmongery, to obtain access to roofs, of the prime cost value of £6 each.

Carpenter's Work to Partitions.

Basement Story.—Frame partitions to water-closets in basement of offices, south-west angle; head and sill, door-posts and door-heads, 4 in. by 4; quarters 4 in. by 2½, and 1¼-inch nogging pieces 2 feet apart.

Ground Story.—Four-inch framed partitions, like the last described, to enclose and divide water-closets and urinals in retiring-room adjoining to Lloyd's staircase; the partitions in front will extend to ceiling; the dividing partions will extend to underside of floors, to be formed to carry cistern, with nogging pieces, as last described.

Mezzanine Story.—Four-and-half-inch framed and braced partitions, to divide the north-west wing; heads, sills, door-posts and heads, and two principal posts, 4½ in. by 4½; braces 4½ in. by 3½; quarters 4½ in. by 2½; 4-inch framed partitions prepared for brick nogging, to divide and enclose urinals and water-closets in retiring room connected with Lloyd's staircase, and also adjoining staircase of the Royal Exchange Assurance, as described before.

One Pair Story.—Framed and braced partitions to divide and form passages, rooms, and lobbies in the Royal Exchange Assurance offices, and also in offices of the London Assurance, and in offices unappropriated in the north-west angle; the circular partitions to have circular heads, sills, and braces; heads, sills, door-posts and door-heads, 6 in. by 4½ in.; braces 6 in. by 4 in.; one middle principal post to each pair of braces 6 in. by 4½ in.; corner posts 6 in. by 6 in.; quarters 6 in. by 2½. The partitions to inclose small dog-leg staircase to upper rooms, to be the same, but quarters, &c. 4½ inches instead of 6 inches thick. Provide, in addition, 60 feet cube fir, and 3 cwt. of bolts and straps, and all labour for trussing the partitions on the Royal Exchange Assurance offices; and also 90 feet cube fir, 4 cwt. of iron, and labour for trussing the partitions of the London Assurance offices; and also 30 feet cube of fir, and 1 cwt. of wrought iron straps and bolts, and all labour for trussing the partitions of the unappropriated offices at the north-west angle.

Frame partitions as will be directed for Lloyd's rooms, using therein 500 feet cube of fir timber.

Fix two tier of strutting to all the partitions except those of Lloyd's on this story. Fix nogging pieces, as before described, to the partitions each side of water-closet under south secondary staircase in the offices of the Royal Exchange Assurance, and fix similar nogging pieces to the partition round small staircase in the unappropriated offices north-west angle.

Second Story.—Frame and fix 5-inch partitions braced to divide the rooms and passages (excepting Lloyd's) of this story, and including also the curbs next flats. Heads, sills, door-posts, heads, principal posts, and braces 5 in. by 4; corner posts 5 in. by 5; quarters 5 in. by 2½. The partition round water-closet and small staircase in the north part of the Royal Exchange Assurance rooms to be the same by only four inches in thickness, and both are to be prepared for brick nogging, as described to other partitions.

The contractor to provide, frame, and fix 100 cubic feet of oak timber in trussing the five and six-inch partitions, as the architect may order, beyond the framing and trussing in fir, already described to be done.

Carpentry in Lintels, Wood Bricks, Window Bond, &c. connected with Doors and Windows.

Doors, Second Story.—Oak lintels 4 inches thick, the width required, and to bear six inches each end; eight wood bricks of oak to door jambs of each doorway in walls, the length needful, and 4 in. by 2¾, and not more than 2 ft. 6 apart.

Doors, First Story.—Oak wood bricks as before; oak lintels 14 in. by 7, and 14 in. by 8, to large doorways, and 14 in. by 5 to one smaller doorway of Lloyd's; oak lintel 27 in. by 4, to two doorways, and 6 in. by 4 to two others in Royal Exchange Assurance offices; one oak lintel 14 in. by 6, to London Assurance; and one 36 in. by 5, one 18 in. by 5, to doorways in unappropriated offices.

Doors, Ground Story.—Generally oak wood bricks, as described before, to all doorways in walls; those doorways which have wood frames to have extra oak bricks framed into the door frames; oak lintels 9 in. by 8 to one, 18 in. by 6 to one, 18 in. by 4 to three, and also four others.

All other doors throughout, except those which have arched heads, to have oak lintels the width of the walls, and of thicknesses varying according to the width of the opening, and in proportion to those already described; and also to have similar oak wood bricks.

The wood bricks in reveals for shop fronts to be of fir, fixed as the others, and the same distance apart. No lintels will be required for windows which will have arched heads; but oak wood bricks 4 in. by 2¾, the length needful, and 2 ft. 6 apart, to be fixed in reveals; and a tier of oak bond, the same scantling, to be fixed in all window backs, 18 inches longer than the width of the openings.

The contractor to provide and fix 100 cubic feet of fir in such templates more than shown or described, as the architect may deem needful and order to be applied.

The contractor to provide and fix in the building 2000 cubic feet of fir bond, in such places and of such scantlings as the architect may direct; all joints of which are to be dove-tailed, lapped, and spiked with large spikes, or pinned with oak.

Sundries in Carpentry..

Ground Story.—Frame loft floors to carry cisterns, &c., over water-closets and urinals in retiring room adjoining Lloyd's staircase, with joints and plates 4 in. by 2½; the plates at ends only, and to be carried by eight iron shoes, fourteen pounds each.

Mezzanine Story.—Lay ¾ deal sound boarding and double fillets to the floors of the Royal Exchange Assurance offices, and also to the rooms and passages in north-west angle over the Banking-house offices.

One-Pair Story.—Lay ¾ deal sound boarding and double fillets to all the floors of the the Royal-Exchange Assurance offices, which have not arches under them.

Second Story.—Lay similar sound boarding and fillets to all those parts of the flooring of this story which are over the committee and the actuary's room, and the governor's two rooms, in the one-pair story of the Royal Exchange Assurance offices.

Generally the carpenter to fix all bolts, straps, and other wrought iron connected with timber work, and also all the cast iron corbels to tie-beams

and socket heads to trusses. Generally the carpenter is to attend upon Slater and Plumber, and he is to cut away and trim for all trades, and reinstate after. He is to examine the carcasing from time to time, and wedge up and secure all timbers, screw up all bolts, drive up all wedges, and prepare the whole for the finishings.

Bracketing and Sundries.

Four-and-a-half inch circular framed bracketting to south end of court-room of the Royal Exchange Assurance offices, to the east end of shipping-office, and to flat arch soffits each side of chimney, in the same office. Fix similar bracketting to form piers, arches, and spandrils, to four arches in passages. Fix similar bracketting to east side of board-room of the unappropriated offices, and also to the lobbies and other parts shown in the plan of the same offices. Fix similar bracketting to form the arched soffits in the London Assurance offices. Provide and fix also all other bracketting needful for the plastering, and which will be described and set forth in the specification of that trade.

The contractor to provide and fix proper strong bracketting for all the ceilings and sides of Lloyd's rooms, including all domes, groins, pendentives, and other architectural decorative parts, to the extent in value £500.

The contractor to provide, frame, and fix, with all extra labour needful, 1000 cubic feet of fir, in braces and cores, for the bracketting througout.

The contractor to execute, beyond what is shown and described, extra bracketting, to be ordered by the architect, to the extent of £150 in value.

The contractor to find all proper rods and moulds for setting out the bracketting.

The contractor to find, in addition to what is described in the specification of smith's work, 25 cwt. of wrought iron straps and bolts, generally small, to secure bracketting; and he is to fix them.

The contractor to find all centring, turning-pieces, and moulds for niche heads, and all extra carpentry needful for the proper and perfect execution of the masonry and brickwork; also all horsing to cornices and landings, and other parts needful. No part to be struck until allowed by the architect; and the whole to be fixed with proper stages, struts, uprights, &c., needful.

The contractor to provide proper and ample casings for the several caps and bases to the columns and pilasters, and for the arrises, strings, cornices, and other projections, wherever it may be deemed necessary, throughout, for all masonry requiring such casing, as stated in the six bills of that trade.

The contractor to provide centres for sundry relieving arches in masonry, to the extent of £50 in value.

The contractor to provide all moulds and trammels for large inverts, and all customary rods for setting out the works.

The contractor to provide for the cost of Kyanising, and extra carting 200 loads of timber.

N.B.—All prices and amounts given in this specification of carpenter's work to be considered prime cost prices; and all the works provided, for which quantities or values are given, are to be examined, measured, valued, and allowed for, either way, according to the provisions of the contract.

(To be Continued.)

SUGGESTIONS FOR IMPROVEMENTS IN TILERIES.

Section 2nd.

After having laid out the plan for the yard and buildings with due regard to the future economical working of the concern, the next object of importance is to build proper kilns for burning the tiles.

A badly constructed kiln goes on wasting coals, labour and time *ad infinitum*, besides spoiling vast quantities of pipes after a considerable amount and labour has been expended in their manufacture.

The principal object to which it is more particularly necessary that attention should be directed in constructing kilns for burning pipe tiles are the following:—First. To ensure a regular and even draught from the fire places to the top of the kiln, not liable to be affected by wind or weather except in very extreme cases. Second, to protect the tiles from the effects of rain or snow, more particularly when first packed in the kiln. Thirdly, to take care that the heat is wasted as little as possible; for which purpose the openings into the kiln should be much smaller than they are usually made, because a waste of heat must lead to a waste of fuel. Fourthly, so to arrange the flues as to ensure the application of a gradual and increasing heat to as large a surface of the tiles as possible; and fifthly, to have the draught at all times under the control of the kilnman independent of wind or weather.

The worst description of kilns are those which are built square and open at the top, with an entrance for packing about three feet wide by six feet in height. This entrance has to be built up every time the kiln is filled, with bricks and wet clay, and consequently the tiles adjoining are never so well burnt as in the others, unless at a great waste of additional fuel after the remainder of the kiln-full is burnt. The top also being covered with sods and clay must necessarily cause an additional waste of heat—and in stormy weather the effect of the wind is it would be on a chimney, whose height was only equal to its diameter: that is to say, the draught is reversed, and blows the fire into the face of the kiln-men. In rainy weather these kind of kilns are generally sheltered from the wet by a few boards nailed together, and set up at an angle against the wind, which, however, always manages to get round them, and sometimes cools the kilns faster at the top, than the fires can warm them at the bottom.

In some tile-works, the kiln is built of a circular form, and covered in with a brick dome; while at the springing of the arch chimnies are run up to a height of ten or twelve feet—say about six chimnies to every kiln. This even is a better method than the one before mentioned, but it incurs a vast expense of brick-work in the dome and chimnies, and there is no way of regulating the draught. It certainly protects the tiles from the weather, but you have still the disadvantage of the large doorway into the kiln.

In burning pipe-tiles, as in burning bricks, it is necessary to smoke them only, for the first twenty-four hours with a very gentle heat, which will be regulated by hearing the pipes crack if the fire gets too strong; when they become dry enough to increase the heat without breaking them, which is known by a change in the colour of the smoke, the fires should be steadily and gradually increased, and as an intense heat at any one point would be sure to crack the pipes if long continueed, the fires should be moved backwards and forwards along the fire places, till the whole mass of tiles is brought to a dull red heat. The fires may then be made as fierce as possible until the tiles at the top of the kiln are well baked, when the mouths of the fire-places should be closed up, and the whole mass left gradually to cool. A careless and inattentive kiln-man will use double the quantity of fuel, besides breaking a considerable number of pipes, compared to one who is vigilant and well understands his business.

The above explanations appeared necessary before referring to the drawings, which have been designed for the purpose of avoiding the before-mentioned disadvantages.

Fig. 1 is the ground plan of a double kiln with the railway in front (as shown in the drawings to section 1st.) It is capable of holding, say thirty thousand inch and half tiles with collars. The contents forming a cube of twelve feet, *i. e.* twelve feet square at top and bottom, and twelve feet in height. It would be useless to have a kiln which would hold more pipes than the shed would dry in a week, and if it held less there would be a waste of fuel, because one of the items in saving coals is the size of the kiln, and for this reason the kiln is made twelve feet in height, as not requiring much more fire than one of half that height.

The walls are shown as three feet in thickness, and should be built of the very best bricks, with less than quarter inch joints if possible, for upon the solidity of the work depends the cheapness of its future working; a saving of twenty pounds, by using inferior materials and inferior work-

manship will ensure a constant waste of perhaps 10s. worth of coal per week, by the escape of heat from the sides of the kiln. It should be built slowly, and in regular courses during dry weather, and fires should be kept constantly lighted, so as to dry the work very thoroughly before a kiln full of tiles is burnt. For want of these very simple precautions, the first two kilns of tiles are often completely spoilt in what they call "seasoning the kiln" thereby incurring a loss of from 15*l*. to 20*l*.

Fig. 1 (*a a a*) shows the openings to the ash-pits under the fire-places—twelve inches wide by eighteen inches in height—widening out to eighteen inches on the exterior face of the wall, in order to increase the draught of air to the fire-place; they are three in number, and extend to within two feet of the opposite end of the kiln, as shown in the elevation (Fig. 2.) The enlarged plan (Fig. 5) on a scale of two feet to an inch, shows a sectional elevation of the ash-pits and fire-places. Two courses of fire-brick project each $2\frac{1}{4}$ from each side of the ash-pit, at the height of eighteen inches, leaving a space of three inches in the clear between them, and at every third brick an additional space is left at the side, as shown in the enlarged plan (Fig. 7, *a a*.) The fire-place widens out to eighteen inches at the springing of the arch. It is adapted either for turf or timber, or a mixture of both; where coals are used, a movable iron grate could be laid on the bricks, as shown in Fig. 7, or a wider aperture might be left, and the number of iron bars increased. The bricks for lining the interior of the fire-places, and also for both rings of the arch over it should be made to pattern of the very best fire-brick, with joints radiating to the centre of curve, so as to avoid using much cement.

The floor of the kiln should be laid perfectly level, with fire-brick nine inches square by three inches thick; at the distance of every eighteen inches a cross flue (see *b b* Fig. 7) is built six inches wide, crossing the fire-places at right angles, and running into the vertical flues in the walls of the kiln. (See also Fig. 4, *b b b*.) They commence from the level of the springing of the arches over the fire-places; if carried down lower they would merely be filled up with ashes to that level.

The vertical flues are shewn in Fig. 2, *a a a a a*, running up to the top of the kiln, six inches by nine inches in depth. An enlarged plan of a part of these flues is shewn in Fig. 6; at every fourth course a brick is inserted across the front to pack the pipes against, thus leaving a space of $4\frac{1}{2} \times 6$ in the clear behind them.

Fig. 4 shows the proposed plan for a covering to the kiln, by which the draught can be regulated to any extent, and the tiles perfectly protected from the wind and weather; it also has this advantage, viz., that one cover serves for two kilns. At the top of the kilns on each side, a rail is laid into the brick-work, so as to run quite clear of the vertical flues. Upon this railway runs a moveable lid on ten cast-iron wheels, thirteen feet six inches square—the bottom of which is lined with thin sheet iron. It may be covered on the top with prepared felt, with a slope of six inches on each side to shoot off the rain. It will easily be perceived by inspecting ig. 2 and Fig. 4, how this moveable lid can be regulated so as to serve both kilns, or to regulate the draught to any extent, by merely pushing it backwards and forwards on the rails. The under side, which is to be lined with sheet iron, should be about nine inches over the top of the kiln, so that the hot air from the vertical flues may pass over the surface of the tiles when burning. The lid can be pushed to the right or the left, according to the direction of the wind, so as to leave an opening of three feet on either side.

In ordinary kilns the fires are made merely in the thickness of the walls, so that the heat has to be transmitted through the mass of tiles from one side only, (the under one) but in this kiln the heat is at once carried to four sides of the tube out of the six, and equally divided over the whole surface.

In order to increase the draught of the fire-places when necessary, and also to make use of the waste heat from the kiln at other times when cooling, five rows of pipes are laid down three inches in diameter, which at the level of the fire-places, pass through the wall of the kiln under the railway, and open out at equal distances along the two drying sheds. The hot air from these pipes will not only assist in quickly drying the pipes in damp weather, but in case of frost it will save perhaps twenty pounds worth of pipes at a time, from being cracked all to pieces. These hot air pipes are shown in Fig. 1, *c c c c c*.

Opposite to the fire-places a shed is to be built with two arches in front, see Figs. 1, 2 & 3; it will serve the double purpose of sheltering the kilnmen, and also to be used as a platform for packing and emptying the upper half of the kiln. The ground in the tile-yard at the point where the rails are laid down being level with the floor of the kiln (see Fig. 2). The lower half of the kiln is filled through an aperture eighteen inches square (see Fig. 2) and for the upper half, the tiles are handed up to the platform, *p p*, and through an aperture eighteen inches square at the top of the kiln (*s* Fig. 2 & 3) both being bricked up when the kilnis full. They are pitched up and filled by boys by hand, just as bricks are loaded into vessels through a hole in the bow.

It may be necessary to observe that the interior of the kiln and flues should be carefully examined at least once a month, as it will be found that in this as well as most other instances, "a stitch in time saves nine."

Feb. 6, 1849. Senlim.

NOVELTIES.

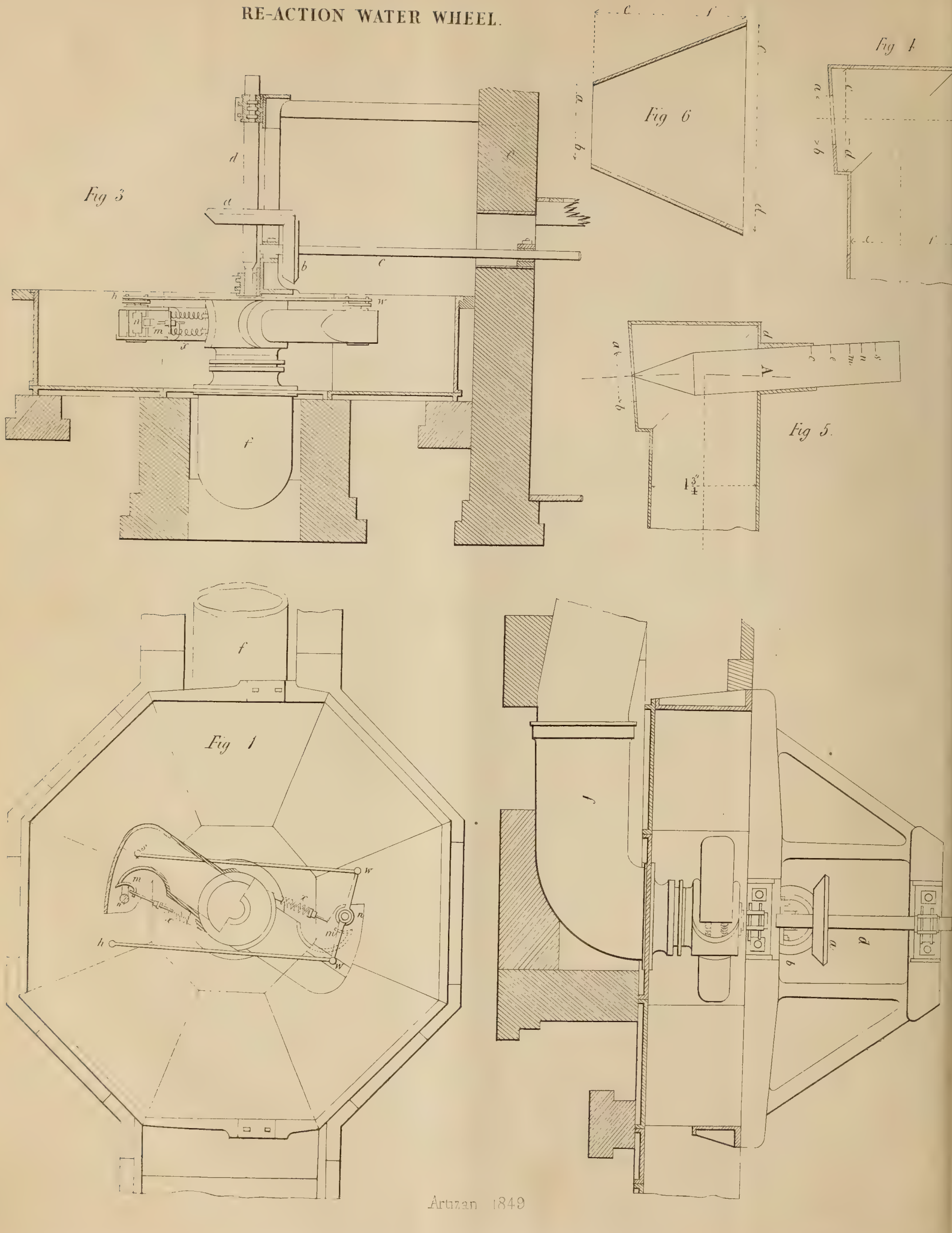
A Hint for Housekeepers.—But few persons are aware of the advantages which may be obtained by simply lining the back and sides of an ordinary fire-place with fire-brick. Every body must have noticed that when a fire goes out, the coals at the sides of the fire are left unburnt, whilst the centre is consumed. This arises from the cooling powers of the iron at the sides, and hence arises the complaint that "you must have a large fire, or none at all." With fire-brick, the whole of the fire, however small, will be kept alight, an object of great consideration in spring and autumn; and even after the fire is extinguished, the fire-brick lining will continue to diffuse warmth for some time. A no less important advantage is, that less smoke is produced, and we may here remark on the absurdity of putting down smoke in factory chimneys, and leaving house chimneys untouched. If the smoke from all the chimneys, say in Russell-square, were combined and poured forth from one huge chimney, it would be voted an intolerable nuisance. As it is, it passes unnoticed. We have only to add that the expense of the alteration is a mere trifle.

An American Patent.—An ingenious American, whose name deserves to be handed down to posterity—Charles Horst, of New Orleans,—has taken out a patent for a rocking-chair, to the back of which is attached a fan, so that the act of rocking, sets the fan in motion, and produces a delectable breeze. We quite wish the hot weather were come, that we might try the experiment in combination with a sherry-cobler.

Exposition of Inventions and Manufactures.—This is a thing which has been long wanted in London, and we are glad to see that the reproach is about to be wiped away by the spirited proprietors of the Baker-street Bazaar, Portman-square. It is proposed to charge a moderate rent according to the space which the models or samples will occupy, and to make the admittance free. We would suggest that on one day of the week, the admittance should be a shilling; this would assist the revenue, and give a quiet day for capitalists and others in search of investments, &c. We fear an objection may be raised against the locality, which is a great distance from the centre of business. Most of our public buildings have been failures. or we would suggest that a spacious building should be erected on the site of the old Fleet Prison, in Farringdon-street, which might be worthy to receive the productions of the inventive genius of English Artizans.

Washing Machine.—A great variety of schemes for washing machines have been tried, but very few seem to have kept their ground. In these days of sanitary reform, the subject assumes an increased importance; and we are glad to see that there is some chance of an efficient and economical one being brought out. Mr. Price has invented, and is now selling, a machine of this description: it consists of a cage made of wooden laths, with solid ends, mounted on bearings, inside an exterior case. The garments to be washed are put inside this cage, together with some wooden balls, loaded with lead, and covered with felt. Soap and water being supplied in proper quantity, the cage is set in motion by a handle outside the case, and the garments become thoroughly cleansed in a short time. As a proof of the efficiency of the apparatus, we may mention that the authorities at the Bank of England have adopted a similar machine for washing the felt used in printing the bank-notes of that establishment.

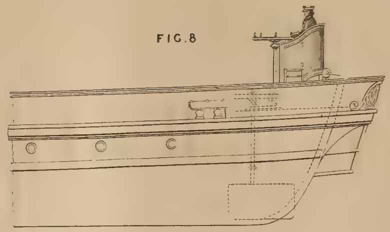
RE-ACTION WATER WHEEL.

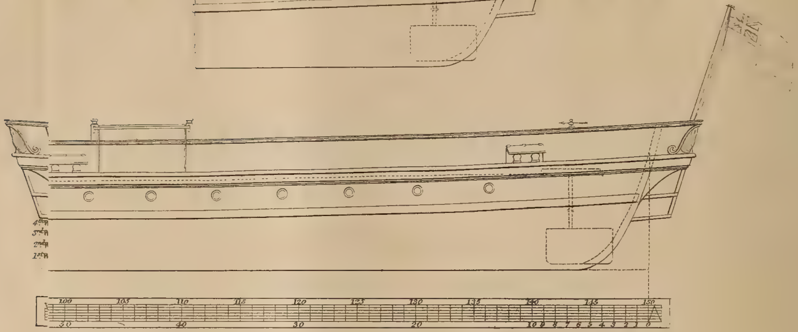


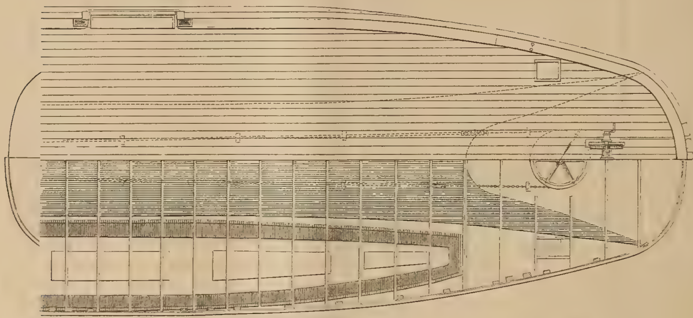
Artizan 1849

AMER.

FIG. 8



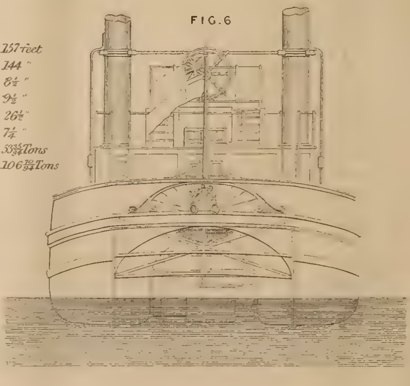




REFERENCE TO VESSEL.

Length on Deck	157 feet
Length of each hull for measurement	144 "
Breadth of each hull	$8\frac{1}{2}$ "
Space between hulls	$9\frac{1}{2}$ "
Breadth over all	$26\frac{1}{2}$ "
Depth from Deck to Cabin Floor	$7\frac{1}{4}$ "
Tonnage of each hull, Builders meas^rmt	$53\frac{35}{94}$ Tons
Total Tonnage	$106\frac{70}{94}$ Tons

FIG. 6



THE ARTIZAN.

No. IV.—Fourth Series—APRIL 1st, 1849.

MECHANICAL ENGINEERING.

PETER BORRIE'S PATENT SAFETY IRON TWIN STEAMER.

One of these vessels is represented in the accompanying plate, the construction and advantages of which will be understood from the several figures therein delineated :—

Fig. 1 is a sheer draught of the vessel, and shows on the right hand an external elevation of the outside of the vessel, and on the left a longitudinal section of one of the hulls.

Fig. 2 is a plan of the vessel, the upper half of which represents on the right a plan of part of the deck, paddle-box, &c.; and on the left are the water lines, both ends being exactly the same. The lower half represents a plan of the deck-beams, and also shows the arrangement of the cabins, engine-room, &c., underneath.

Fig. 3 is a midship section of the vessel.

Fig. 4 is a half-body plan or transverse section of the vessel at each frame.

Fig. 5 is a plan of the deck, houses, &c.

Fig. 6. is an end view of the vessel, both ends being exactly the same.

Fig. 7 and 8 represent a different method of steering from that represented in the other parts of the drawing.

This vessel, as represented, is chiefly constructed of iron, having two separate hulls placed side by side, with a space between them in which the paddle-wheel works, and strongly connected together at the deck (which passes over all), and also by a plate iron arch and stays between the hulls. The hulls thus joined afford a great extent of deck room with a very small amount of tonnage, or of resistance from the area of the section passing through the fluid; and, as both ends are exactly similar, the vessel will sail with equal facility either way without turning. It will be observed in the plate that the keels and stems are not placed in the centre of the hulls, but are situated towards the inside of them, and thus making the water-lines very fine on the inside, so as to diminish the tendency of the water to gorge up between the hulls, which is found to take place in twin steamers as commonly constructed, and which gorging up of the water not only tends to separate the two hulls, but also greatly increases the resistance of the vessel in passing through the water. It will also be observed that the inner bilges of the two hulls are much fuller than the outer ones, and thus affording a greater degree of buoyancy on the inside, which is necessary in order to support the weight of the deck, &c., between the hulls.

The vessel represented in the plate is one adapted for river navigation, at a high degree of velocity; but a vessel required for a ferry or for sea-going purposes, would be made broader in proportion to her length, according to the trade in which she was to be placed.

The vessel shown in the plate is $157\frac{1}{2}$ feet long, and $26\frac{1}{2}$ feet broad on deck; each hull being $8\frac{1}{2}$ feet broad, with a space of $9\frac{1}{2}$ feet between them. The frames are of angle iron, and are spaced, as shown in the plate, the outside plating being securely rivetted to them. The keels are formed by curving the plates downwards, so as to form channels for the bilge-water inside of the hulls; but in sea-going and other vessels, where the draft of water is greater, I make the keel of iron bars, and rivet the garboard strakes upon them in the usual way. The plating is not carried to the top of the frames on the inside of the hulls, except at the space in the middle for the paddle-wheel, but is carried up to the deck, so as to form an arch between the two hulls, which are also bound together with iron stays at the springing of the arch. The deck beams are of ┳ shaped iron, securely fastened at the ends to the frames, and at the middle to the top of the arch. The deck-planks are fixed to these beams by screws passing through the flanges of the beams, and are caulked and made water-tight in the usual way. Each of the hulls is divided into compartments by water-tight bulkheads; and the compartments at the extreme ends may be used as tanks for trimming the vessel, which tanks will have proper cocks and pipes to admit the water, or to discharge it into the bottom of the vessels, from which it will be pumped out by the engines. On the outside of the vessel there are two fender-strakes of timber, one at the deck and the other a little above the load water-line; and these will effectually prevent the vessel from sustaining any damage from rubbing against any pier or floating body or vessel with which she may come in contact. There are also two fenders formed of angle iron, one at each end, to prevent boats, &c., from getting into the canal or space between the hulls. The deck is bounded by bulwarks, which have two large gangways on each side, hinged at the lower side to the deck, and lifted up or lowered by winches attached to the bulwarks. These gangways would be chiefly used for the passage of horses, carriages, &c., to or from the vessel; and for the accommodation of passengers there is a smaller gangway on each side. On each end of the paddle-box are a number of deck-houses, which are shown in plan in fig. 5: *a* is a cook-house,

PETER BORRIE'S PATENT SAFETY IRON TWIN STEAMER.

FIG. 7

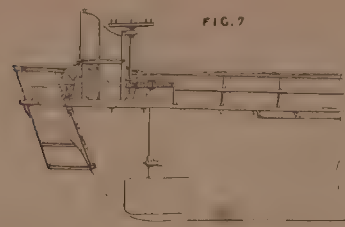


FIG. 1

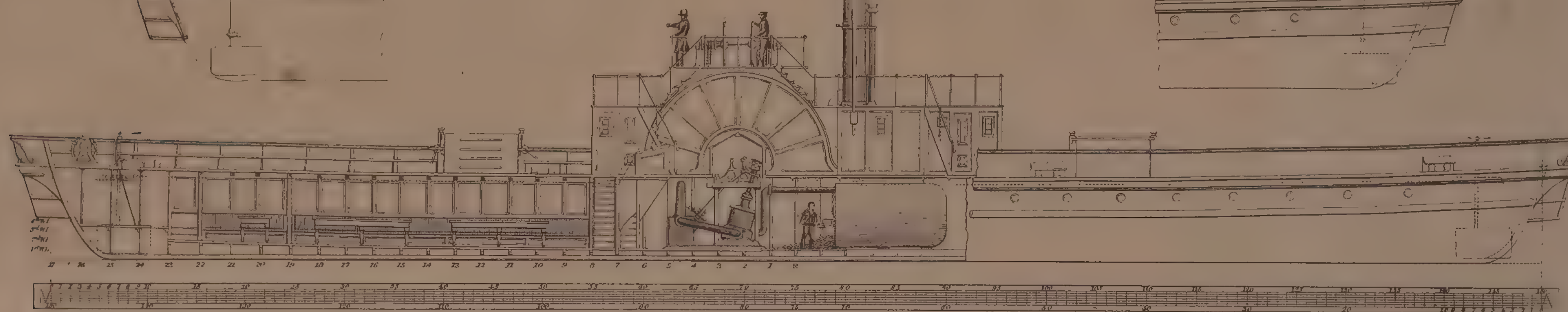


FIG. 8

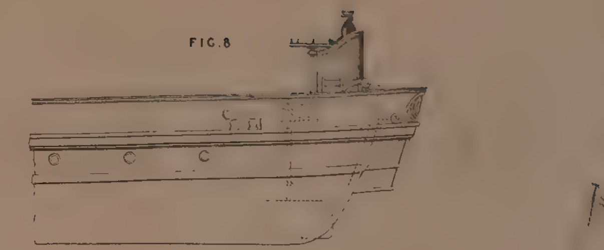


FIG. 2

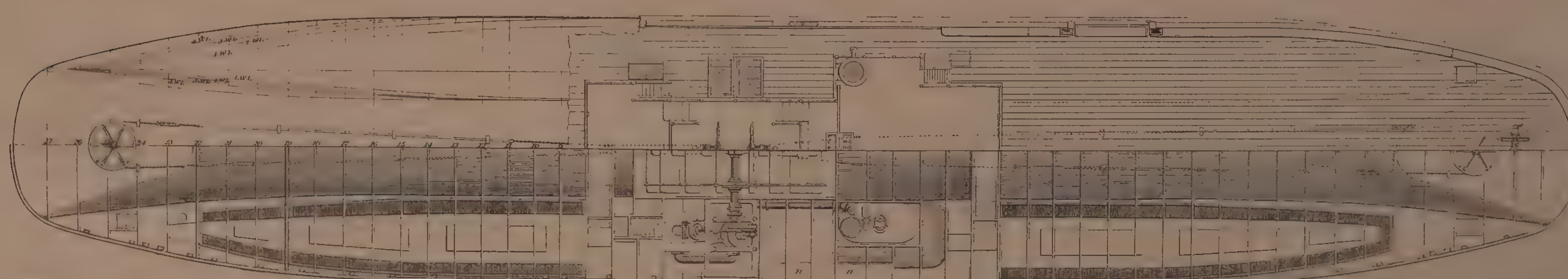
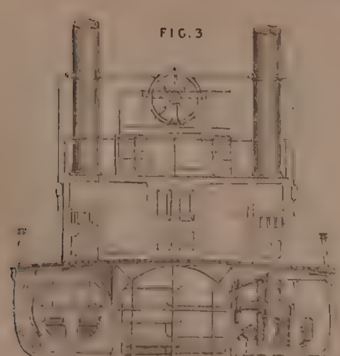


FIG. 3



REFERENCE TO ENGINES.

Diameter of Cylinders	26 Inches
Stroke of Do	42 "
No of strokes per minute	36
Diameter of Air Pump	14½ Inches
Stroke of Do	32 "
Diameter of Paddle Wheel	17½ Feet
Breadth over Floats	9 "

FIG. 4

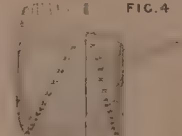
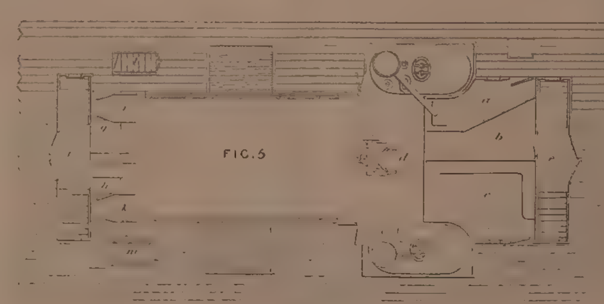


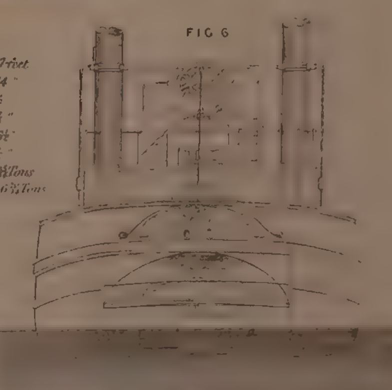
FIG. 5



REFERENCE TO VESSEL.

Length on Deck	157 Feet
Length of each hull for measurement	144 "
Breadth of each hull	8½
Space between hulls	9½ "
Breadth over all	26½ "
Depth from Deck to Cabin Floor	7¼ "
Tonnage of each hull, Builders measmt	53[illegible] Tons
Total Tonnage	106[illegible] Tons

FIG. 6



with apparatus in it for cooking by steam; *b* is a state room; *c* a dining-room; *d* the engineer's room, in which he starts and stops the engines, and which having a sky-light at tne top, the captain can communicate immediately with the engineer, without the clumsy method of employing a call-boy; *e* is the passage and stairs to the saloons at one end of the vessel, and *f* those to the saloons at the other end; *g* and *h* are water-closets; *i* and *k* are urinals; and *l* and *m* are stairs to the engine-rooms. On the top of the deck-houses and paddle-box is a platform or hurricane deck, upon which the steering-wheels are placed, and this being properly railed in, may be used as a promenade for passengers, affording, from its elevated position, an excellent view of surrounding scenery, and on this account, passengers going upon this deck would have to pay an extra fare. All along the bulwarks seats are fixed for the accommodation of the passengers, as shown in plate, with a number of moveable seats placed in different parts of the deck not there represented; also, from the extent of deck, marquees or tents could be erected on it at at any time for the accommodation of parties. The vessel having to sail with equal facility either way without turning, is fitted with a rudder at each end. This rudder is in the middle of the canal or space between the hulls, and is formed of an iron plate upon a shaft or spindle coming up to the deck, which shaft is not in the centre of the plate, but at about one-third of its length from the one side, so that the pressure of the water against the rudder acts partly on both sides of its centre of motion; but when the rudder is left free it will always accommodate itself to the direction of the vessel's motion, on account of having the one end longer than the other from the centre of motion. There are two methods shown in the plate of arranging the steering apparatus. In the first, as shown in figs. 1, 2, 3, and 6, the steering-wheels are placed on the top of the paddle-box in the middle of the vessel, and thus the man at the wheel, from his elevated position, has a clear view of all objects in the way of the vessel, and steers her accordingly. The connection between the steering-wheels and the spindles of the rudders is formed partly by chains and partly by rods; the chains passing round wheels fixed on the top of the spindles and round barrels fixed to the steering-wheels, as is clearly shown in figs. 1 and 2. As one rudder is only required to be worked at a time, according to the direction in which the vessel is sailing, each of the wheels is fitted with catches for making it fast in a proper position when not in use; but both rudders may be used at a time with advantage when laying the vessel alongside a pier, which one man can do with ease. The spindles of the rudders pass through the deck, and are adapted for an iron tiller, which would only be required in cases of the connecting-chains breaking or otherwise getting out of order; and on the top of them are connected small upright shafts carrying arrows, which always point out to the man at the wheel the exact position of the rudders. The other arrangement of the steering apparatus is shown in figs. 7 and 8, which perhaps may be better adapted for a ferry-boat or for a vessel plying on a river with a strong current where frequent stoppages have to be made. It will be seen that in this case the rudder-spindles, as in the former case, pass through the deck, and have toothed wheels fixed upon them, working above the deck, and into each of these wheels a pinion gears, which pinion is upon an upright shaft upon which a horizontal steering-wheel is fixed, so that the steersman stands upon a platform raised several feet above the deck. The rudders may be locked in a proper position when not in use, and, as in the former case, each of the spindles has an arrow on the top of it to point out to the steersman the position of the rudders. The vessel is furnished with two light anchors, and with a winch at each end for heaving up the anchors or hauling the vessel in either direction when the steam is not up.

There are four cabins in the vessel, each being about 39 ft. long and 8 ft. wide. One of these has a portion of it partitioned off at the end, so as to form a lady's cabin; and the whole are furnished with tables, sofas, and other conveniences, and are lighted by round windows in the sides, which can be opened or closed at pleasure, and the spaces above the arch between the hulls may be formed into lockers opening into these cabins, which may be used for holding stores or passengers' luggage. The entrances to the cabins are at each end of the deck-houses, as formerly described, one entrance being common to two of the cabins. The spaces at the extremities beyond the cabins are fitted with berths for the crew, and also contain at their bottoms the water-tanks for trimming the vessel, as before explained.

The engines, as shown in the plate, are condensing or low-pressure engines, on the oscillating principle, but any other description of direct-acting or beam-engines may be used. The boilers are tubular, and, from their cylindrical shape, are capable of standing a great pressure with perfect safety. These boilers have their tubes fitted so that there is a considerable inclination on them towards the back end, and accordingly there will be always a large body of water above them where the heat is greatest, and as the tubes are above the furnaces there will be no chance of the tops of the furnaces being bared, and thus all liability to danger from overheating the different parts of the boilers is guarded against. Each boiler is fitted with two safety-valves of the most improved construction and of large area, the area of one of them being quite adequate for the escape of the whole steam which the boiler is capable of generating. This is necessary, as I have no doubt that most of the accidents which happen in steamers from explosions are occasioned by a deficiency of area and proper arrangement in the safety-valves, and not from overheating the boilers, and the generating of gas, as is generally supposed. One of these valves is loaded to the maximum pressure at which the steam is intended to be worked in the engines, and locked up, so that the engineer has no access to it, and by this means he is prevented from putting any dangerous pressure upon the boiler, which is often done in cases of racing, where such precaution is not taken. The other safety-valve is attached by a lever to a spring balance, so that the exact amount of pressure in the boiler is indicated.

Both boilers are also fitted with proper blow-off pipes and cocks, guage-cocks and glasses, and other fittings requisite for the proper working of the boilers, and to prevent the possibility of explosions.

It may be remarked, that it is on account of the safety-valves of steam boilers being too small in proportion to the generating power of such boilers, and for want of proper arrangements, that almost the whole of the explosions of steamers take place; for it is well known that these explosions generally happen when the vessel is lying alongside a wharf or quay, in which case, when the fires are full, and the steam-generating power of the boiler in full operation; and as at this time the steam thus generating is not used in the engines, an explosion will undoubtedly take place, unless a proper egress through the safety valves be allowed for its escape.

There is one engine with its boiler and coal-box (*n*) at the side placed in each hull, the engines being connected by the main shaft, on which their respective cranks are fixed at right angles to each other, and on the middle of this shaft the paddle-wheel is keyed. The engines being supplied with steam at a considerable pressure, are enabled to carry out the principle of expansion to a high degree, and are provided with proper apparatus to cut off the steam at different parts of the stroke, according as the vessel is lightly or heavily laden, or to the state of the wind or tide opposed to the vessel, and thus rendering the consumption of fuel of the smallest possible amount in proportion to the work done. The paddle-wheel is of large diameter and great breadth, in order to get sufficient surface of float-board. The float-boards are made in two lengths, those on the one side coming in the middle between those on the other side; and thus causing only about one-half of the surface of the float to strike the water at once, the concussion is greatly reduced, and the unpleasant motion common in steam vessels almost entirely done away with. There is, of course, a funnel for each boiler, which is jointed, so that it can be lowered, if required, in passing under bridges. The engines, as before stated, are started or stopped on deck; and the whole apparatus for this purpose is so arranged, that any person very little acquainted with steam engines could immediately stop the vessel, or start her in either direction; and thus there will be less chance of the engineer making any mistakes; and as he is in the immediate vicinity of the captain upon the paddle-box, the captain can give him his orders directly, without the intervention of any third party. The safety-valves upon the boilers being also accessible from the engineer's room on deck, he will have very little occasion to be long absent from his room during a passage.

Having thus described the several parts of the vessel and machinery, I

will now proceed to point out a few of the advantages of steam vessels of this construction:—Firstly, of the safety of the vessel. This vessel having two hulls, and these being divided into compartments by water-tight bulk-heads, of course the number of compartments will be double that of a single vessel with the same number of bulk-heads, and consequently, its safety is increased in a proportionate degree. Again, it is found, that, in river vessels which are crowded with passengers, there is often great danger from the passengers crowding to one side, and thus causing the vessel to heel over; but from the construction of this vessel, this tendency of the vessel to heel is entirely remedied, as the buoyant parts are at the extremities of its breadth. Again, in rivers crowded with wherries and other small craft, such as the Thames, these craft are often endangered from the heavy swell caused by the passing of steam vessels; but this vessel causes no swell, there only being a slight ripple passing out at the end of the canal or space between the hulls; and here I may mention, that on that account a steam vessel of this description would be admirably adapted for navigating canals, as it would have no tendency to injure their banks, and if the outside bilges were well rounded, the vessel could approach near enough to the bank to allow the gangways to be lowered on the top of it, and thus to load or discharge with ease goods, passengers, carriages, &c., at any part of the canal.

Secondly, of the increased number of passengers, &c.:—It will be found that a vessel of this construction will carry with ease and safety three times the number of passengers as a common vessel of the same tonnage, and with the same or even less expense in working the vessel; so that it would require a common vessel of three times the tonnage to carry the same number of passengers: and, as the power would have to be increased proportionably, the number of hands to work the vessel being also increased, and as the whole of river pier-dues, &c., is proportioned to the tonnage, the amount of expense in working such a vessel would greatly exceed that which is required to work an improved twin vessel to carry the same number of passengers. It will also be evident that a vessel on this construction, from the extent of deck and cabin room, will afford very superior accommodation to pleasure parties going on excursions; and, from the vessel having no rolling or other disagreeable motion, such parties would find themselves as comfortable as in a room on land. An improved twin vessel may also be constructed to have every facility for carrying goods; and is adapted in a superior manner for the conveyance of carts, carriages, and other vehicles, as any vehicle may drive aboard or ashore without even disengaging the horses. It would also be found to be a very superior vessel for the conveyance of cattle, sheep, horses, or any kind of live stock, from its great stability and extent of deck surface.

Thirdly, of the economy of twin vessels:—It has been shown above that three times the number of passengers can be carried at the same or even less expense than in steam vessels of common construction. It is true the building of the twin vessel will cost somewhat more per ton than that of the other; but the cost of the machinery in both will be the same, and the action of the same power of engines in the twin vessel will be much more effective, on account of the paddle-wheel being in the middle of the vessel; and consequently, when the vessel is loaded, having a uniform immersion in the water—whereas common steamers, having a great tendency to roll or heel over, have their paddle-wheel on one side buried in the water, while that on the other side is working almost out of the water altogether, and consequently destroying the effective action of the machinery—indeed, in the twin steamer shown in the plate, I calculate that the extremity of the paddle-wheel will have a velocity of upwards of 21 miles an hour; so that, owing to its uniform action and its uniform immersion, and the fineness of the water-lines of the vessel, it may be safely affirmed that she will go at a velocity of 16 miles an hour in still water, and that her draught of water, when loaded, will not exceed 3½ feet. Another source of economy will be in the wear and tear being much less; for it will be found that in steamers, as commonly constructed, one great cause of expense for repairs is the liability of the projecting paddle-boxes and wheels coming foul of other vessels, piers, &c., and being partly or wholly carried away; whereas, in the twin steamer, the wheel being in the middle of the vessel, it is effectually protected, and the vessel can be laid close alongside a quay or pier with great facility; and when the bulwark gangways are lowered down, goods, passengers, carriages, &c., may be taken on board or landed with the greatest dispatch. Another arrangement, which greatly tends to lessen the liability to collisions in crowded rivers, and consequently to lessen the expense for repairs, &c., is the steering of the vessel upon the top of the paddle-box, or on raised platforms at the ends, as formerly described; the man at the wheel, from his elevated position, having a clear view of all surrounding objects, and accordingly is enabled to steer clear of them; and again, the engineer stopping and starting the engines on deck, receives his orders immediately from the captain, so that he is not so apt to misunderstand such orders; and thus another cause of frequent accidents is avoided.

In comparing this vessel with some of the largest passenger vessels on the Thames, I find that the facts advanced above are fully verified; for, although this vessel is only about one-third of the tonnage of some of the steamers I have compared her with, yet she has more area of deck, and her cabins are also of greater extent and much more commodious.

Now, although this vessel is particularly designed for river navigation at a high rate of velocity, the same principle of construction may be applied to vessels for sea-going purposes, or for ferries, which vessels, from the strong manner in which they are constructed, with the middle arch and stays combining the two hulls, could be made to withstand the heaviest seas, combined with all the advantages enumerated above. And in such vessels, designed for carrying heavy cargoes, it would be advisable to use wheels with moveable or eccentric floats, so that they shall enter and leave the water in a perpendicular direction.

In conclusion, and as illustrative of the correctness of what I have here stated, I will make a comparison between two vessels which I constructed for the ferry across the Firth of Tay, between Dundee and Newport, some time ago, and which are still working, and in good order. It may be here noticed, that at this ferry the vessels are exposed to strong gales and heavy seas from the German ocean on the east, and that the Firth has also a long "fetch" to the westward, which often causes heavy seas when the wind blows hard from that quarter. One of the vessels, viz., the "Tayfield," is a single vessel, with a paddle-wheel on both sides, and a rudder at each end, so that she can sail with equal facility either way without turning. The other vessel, viz., the "Princess Royal," is a twin steamer; and, although not built with all the improvements shown in the accompanying plate, and herein described, yet the comparison will show in some measure the superiority of this construction of steam vessels over those of the common construction.

COMPARISON BETWEEN THE "TAYFIELD" AND THE "PRINCESS ROYAL," FERRY STEAMERS, AT TAY FERRIES:—

	"Tayfield," Single Vessel.	"Princess Royal," Twin Vessel.
Length for measurement	94 feet	95 feet
Breadth of one hull in twin vessel	....	11½ ,,
Breadth over beam	20 feet	33½ ,,
Tonnage, Builder's measurement..	174 tons	124 tons
Area on deck for passengers, carriages, &c.	1,802 sq. ft.	3,066 sq. ft.
Power of engines....................	60 h. p.	60 h. p.
Date of construction..................	1836.	1840.

From the above comparative statement it will be observed that, although the tonnage of the single vessel is fully $1\frac{4}{10}$ that of the twin vessel, yet her area on deck for the accommodation of passengers, carriages, &c., is less, in the proportion of 1802 to 3066, or about 1 to $1\frac{7}{10}$. The accommodation for the passengers, &c., is not only greatly increased in proportion to the tonnage in the twin steamer, but also she is found in rough weather to be by far the most available vessel, owing to her being free from the rolling motion which impedes the progress of the other; and it is also found that all times she makes her passages in a much shorter time than the single vessel, although the steam power of both is exactly the same.

COMPARISON BETWEEN A COMMON RIVER STEAM VESSEL AND A TWIN STEAMER.

The resistance experienced by vessels in sailing is of two kinds. The first and principal resistance is occasioned by the displacement of the water as the vessel sails through it; and is proportional to the area of the mid-ship section of the displacement and square of the velocity of the vessel. The other source of resistance is the friction of the water on the immersed part of the vessel, which is of small amount compared with the former. By calculating these resistances therefore, for any vessel, we may form a correct idea of its sailing capabilities with a given amount of power.

In order to compare the resistance offered to a Twin Steamer and that to a vessel of the common construction, we must calculate these resistances for both vessels, and thus find out what their sailing capabilities are with a given amount of power. Suppose we take the Gravesend steamer Ruby, as an example of the common steamer, and a Twin Steamer, each of the hulls of which is 9 feet broad, with a space of 11 feet between them. Let the length of this steamer be 170 feet, which is nearly the same as that of the Ruby, whose breadth of beam is 19 feet, or a little more than twice that of one of the hulls of the Twin Steamer. The area of the midship section of the displacement of the Ruby is about 65 square feet, and that of the Twin Steamer is only 50 square feet, so that the resistances from the displacement of the water will be in these proportions. The speed of the Ruby is about 14 miles an hour; and we will, therefore, calculate the resistance of both vessels at this speed.

From the results of experiments made by Colonel Beaufoy, it was found that the resistance to a plane of one square foot, was about 204 lbs. when moving with a velocity of 810 feet per minute. But 14 miles per hour is 1,232 feet per minute, therefore the resistance will be as 810^2 to $1,232^2$, or, as 1 to 2.313, so that the resistance per square foot at this velocity will be $204 \times 2.313 = 471.85$ lbs. The resistance, therefore,

In the Ruby will be $471.85 \times 65 = 30,670$ lbs., and
" Twin Steamer $471.85 \times 50 = 23,592$ "

The other source of resistance is the friction of the water upon the bottom of the vessel, and, according to Professor Leslie's Elements of Natural Philosophy, this will be proportional to the surface immersed; and for the purpose of comparison we may take it at one pound per foot, at a velocity of 14 miles per hour. Now the area of the immersed part of the Ruby is about 2,700 feet, while that of the immersed part of the hulls of the Twin Steamer is 3,500 feet; and this resistance will therefore be,

In the Ruby, say . 2,700 lbs., and
" Twin Steamer . 3,500 "

Adding these resistences to those obtained for the displacement, the total resistance will be—

For the Ruby . . 33,370 lbs., and
" Twin Steamer . 27,092 "

It has been found by Mr. P. Barlow, from an extensive set of experiments, made by him with different Steamers, that the resistance of a well shaped Steamer, with good lines, is not more than 1-17th of the resistance thus found, so that the resistance for

The Ruby will be . $\frac{33,370}{17} = 1962.9$ lbs, and

The Twin Steamer . $\frac{27,092}{17} = 1593.6$ "

But as the vessels have to move with these resistances at a velocity of 1,232 feet per minute, the power spent in propelling them may be found thus, that for

The Ruby being . $\frac{1962.9 \times 1232}{33,000} = 73.2$ horses power, and for

The Twin Steamer. $\frac{1593.6 \times 1232}{33,000} = 59.4$ "

But it was found by the same authority (Mr. Barlow) that one-third of the whole power was lost by the retrograding of the paddle wheels, therefore the whole power expended will be

For the Ruby . $\frac{73.2 \times 3}{2} = 109.8$ horses power, and

" Twin Steamer $\frac{59.4 \times 3}{2} = 89.1$ "

The result of the above calculations proves the correctness of the data upon which they are founded, as the engines on board the Ruby are given out for 100-horses power; but it is always found that engines work above the power they are given out for, as in this case the difference amounts to about 10-horses power, which is no great degree of exeess. These calculations therefore prove, that 80 nominal horses power in the Twin Steamer is capable of producing as great a velocity as 100 nominal horses power in the Ruby.

In the above calculations, however, we have considered both vessels as possessing equal advantages with regard to the effective action of the machinery; but the Twin Steamer would be very superior to the other in this respect, as the paddle-wheel being in the middle will always have a uniform immersion, while those of the other vessel, from her liability to roll and heel over to one side, have much of their effect in propelling the vessel destroyed, so that from this cause alone the velocity of the Twin Steamer will be greatly superior.

It has been said that Twin Steamers have not hitherto been made to attain any great degree of velocity; but the reason of this is that they have always been made with their water lines the same in the canal as on the outside of the vessel, and consequently not fine enough, so that the water is gorged up between the hulls, and offers great resistance to the progress of the vessel. In the construction of this Twin Steamer, however, the lines in the canal are extremely fine on account of the keels being out of the middle of the hulls, and consequently there will be no gorging up of the water as in Twin Steamers as hitherto constructed.

Although the Twin Steamer will carry from two to three times the number of passenges that the Ruby can, she is only the same length and about eleven feet narrower than the Ruby over the paddle boxes; and as the shaft of the Twin Steamer is only in the middle of the vessel, and does not come all the way across the deck, it can be kept considerably higher than the deck so as to allow for a large diameter of paddle wheel and a long stroke to the engines.

For these reasons the action of the machinery will be much more effective in the Twin Steamer, and from the extreme fineness of her lines on account of the great length and narrowness of her hulls, her velocity, with 80-horses power, may be safely calculated at not being less than from seventeen to eighteen miles an hour; for although in the foregoing calculations (for the sake of comparison), I have supposed the proportional resistance in the Ruby and Twin Steamer to be the same, viz., 1-17th of the whole resistance, yet it will be found that in a vessel with so fine lines as the Twin Steamer, it will not amount to more than 1-25th or 1-26th. The Twin Steamer will also be found much more manageable in a narrow and crowded river, being eleven feet narrower over all than the other, although carrying nearly three times the number of passengers, and there can therefore be no doubt of its superiority as regards economy, speed, safety, comfort, and convenience.

PETER BORRIE,
Engineer.

DESCRIPTION OF THE RE-ACTION WATER-WHEEL, AT MR. J. POYNTER'S WORKS, GREENOCK.

(Continued from page 51.)

Fig. 1 is a plan, and figs. 2 and 3, elevations of a water-mill of 38 horses power, recently erected at Greenock in the works of Mr. John Poynter, by Mr. Whitelaw. This machine does the work it has to do in an extremely satisfactory manner; the fall it is actuated by, is 22 feet, and the quantity of water 1200 cubic feet per minute.

The water-mill works in a cast-iron cistern of an octagonal shape, and a canal, made of the metal named, conducts the tail water out of that cistern. The cast-iron framing which supports the water-mill is bolted to the top of the cistern, and is steadied by two cast-iron ribs, which are wedged in the wall *o* at one end, and the other end of each is fastened to the top of framing as shown in fig. 3. A pair of bevel wheels, *a* and *b*, and the horizontal shaft *c* transmit the motion of *d*, the upright shaft, to the machinery that is driven by the water-mill. From the lead, or top of the fall, the water is led to the water-mill by the main pipe *f*. The cross section of the arms is not of an elliptical shape, but is semicircular at each side, and there is a flat part $7\frac{3}{4}$ inches broad on the top and bottom; the arms are $18\frac{1}{2}$ inches wide by $10\frac{3}{4}$ inches deep.

The governor is so simple and perfect in its action, that this alone would render the water-mill superior to any of the ordinary sort of water-wheels, even if it had not some additional advantages over the other motors named. The governor is seen in figs. 1 and 3, but with the exception of two of the springs is not shown in fig. 2, as in this fig. some of the other parts could not have been so distinctly represented had the governor been shown in it. Each regulating valve *m*, turns on the spindle *n* as a centre, and, as will be evident, the valves allow more or less water to escape according as they are turned *towards* or *from* the centre of the water-mill. Each valve is connected to a pair of spiral springs *x*, and the required degree of motion is given to the valves either by the force of the springs, or by the centrifugal force which the motion of the water-mill communicates to the valves. Thus, if the water-mill work at too quick a speed, the increase of centrifugal force, given to the valves, carries them outwards or from the centre of the water-mill, and in this way the expenditure of the water, as also the power of the water-mill are diminished; but if the water-mill happens to go too slow, the force of the springs draws the valves inwards, and gives the water-mill more power by allowing a greater quantity of water to escape; and thus the motion of the water-mill is scarcely allowed to vary, as the least possible difference in the speed, causes the valves to move so as to prevent the water-mill from revolving either too quick or too slow at any time. To prevent the one valve from acting before the other, the spindles *n* are carried out through the top plates of the water-mill, and a lever *w w* is fastened on the top of the one spindle, and another lever, *s h*, (shown by a dotted line in fig. 1,) on the top of the other, and the rods *w s* and *w h* connect the two levers together, so that the one cannot shift without taking the other along with it. As the kind of water-tight joint used was described on some former occasion, nothing more need be said about it, and as every other part is now explained, we shall conclude this description of the machine at present under consideration, by giving the dimensions, &c., of some of the principal parts.

Upright shaft made of malleable iron—diameter of bottom journal 4 inches.

Jet orifices $10\frac{1}{2}$ by $2\frac{3}{4}$ inches.

Diameter of water-mill 102 inches, that is, each arm is 51 inches long, measuring from centre of water-mill to centre of jet orifice.

Main pipe 3 feet diameter, and central opening $22\frac{1}{2}$ inches diameter.

Speed of water-mill $85\frac{1}{2}$ revolutions per minute.

By carefully examining the articles that have lately appeared in the *Artizan* on the subject at present under consideration, the following errors have been detected.

In the Number for February, 1848, second line from end of article, *for* pan *read* fan.

In the Number for November last, ninth line from bottom of page 239, *for* H *read* H 1, in same page, line seventh from bottom, *for* of *read* or.

In equation 4th *for* $\left(\frac{v}{8.046}\right)^{?}$ *read* $\left(\frac{v}{8.046}\right)^2$

5th *for* $\Big]^{\frac{1}{2}}—v$ *read* $\Big]^{\frac{1}{2}}—v$

9th *for* $\left(\frac{v^2}{8.046}\right)$ *read* $\left(\frac{v}{8.046}\right)^2$

10th *for* $\left(\frac{v}{8.046}\right)$ *read* $\left(\frac{v}{8.046}\right)^2$

13th *for* $^{v}—7.87$ *read* $v—7.87$

In same line with equation 7th *for* h 4.33 *read* h : 433, and in the 5th column of table 4th (p. 215) *for* 74.60 *read* 72.60.

DIMENSIONS AND DETAILS OF NEW STEAMERS.

"JUVERNA," THE PROPERTY OF THE BRISTOL AND CORK STEAM NAVIGATION COMPANY.

Built and fitted by Messrs. George Lunell and Co., Bristol.

	Feet.
Length on deck	180·8
Ditto over all	205
Breadth on ditto, amidships	25
Depth of hold, at ditto	14·5
Length of engine room	52·6
TONNAGE.	Tons.
Register	$348\frac{2052}{3500}$
Engine room contents	$206\frac{1253}{3500}$
Total	$554\frac{3305}{3500}$

Two side lever engines of 274 horse nominal power, with malleable iron framing.

	Feet.	In.
Diameter of cylinders		61 ins.
Length of stroke	5 „	3
Diam. of paddle wheels (extreme)	24 „	5
Ditto ditto effective	23 „	10
Length of floats	7 „	2
Breadth of ditto	2 „	6

Two sets of arms, 10 in each.

Two tubular boilers, six furnaces, and 318 wrought iron tubes, $2\frac{3}{4}$ inches diameter. Consumption of coals per hour, 25 cwt.

On her first trip from Bristol to Cork, 264 miles, on the 28th April, 1847, the average speed of the *Juverna* was 12 knots per hour, the engines making 19 revolutions per minute. Draft of water, average, 8ft. 6in. forward, and 9ft. 10in. aft.

The frames of the hull are of patent thick-edged wrought iron.

The *Juverna* has a full female figure head, sham quarter galleries, a square stern, standing boltsprit, three masts, schooner-rigged, and is commanded by Mr. John Gilmore, late of the *Rose.*

THE CLYDE SHIPPING COMPANY'S IRON STEAM TUG, "METEOR."

Built and fitted by Messrs. Caird and Co., Greenock.

	Feet.
Length on deck	105·9
Breadth on ditto, amidships	17·6
Depth of hold, ditto	8·6
Length of engine space	60·2
TONNAGE	Tons.
Hull	$129\frac{37}{100}$
Engine space	$98\frac{61}{100}$
Register	$30\frac{76}{0}$

Two half-lever engines of 62 horse nominal power.

	Feet.	Ins.
Diameter of cylinders		30 ins.
Length of stroke	4 „	6
Feathering paddle wheels, diameter ...	14 „	0
Length of floats	6 „	5
Breadth of ditto	2 „	0

Two sets of rings, with 12 arms and floats.

One tubular boiler.

	Feet.	Ins.
Length at top	9 „	6
Ditto, at bottom	9 „	0
Breadth of ditto	14 „	3
Height of ditto	8 „	0

Length of steam chest at top	7 „	0
Ditto, at bottom	9 „	0
Breadth, at top	6 „	0
Ditto, at bottom	7 „	0
Height of ditto	4 „	0
Length of furnaces, (4 No.)	6 „	0
Breadth of ditto	2 „	10
Depth of ditto	3 „	0
190 wrought iron tubes, length	6 „	0
Internal diameter of ditto	0 „	$3\frac{1}{4}$

There are seven strakes of plates from keel to gunwale.

The steering wheel is placed on a raised platform over the engine room, about 3 feet from the deck.

The *Meteor* was launched on 1st January, 1849, and made her trial trip on 1st February, and began to tow on 3rd. She was built to compete with the *Jenny Lind* (fitted by Mr. Marshal, of South Shields, for details of which vessel see p. 194 of last vol.), and is rather superior to her in speed. Load draft of water 5ft. 5in. forward, and 5ft. 11in. aft. The *Meteor* is the thirteenth iron vessel built by Messrs. Caird and Co., and is commanded by Mr. Alexander Archibald, late of the *Samson*, one of the first towing vessels on the Clyde, having been built in 1819.

THE IRON SCREW STEAMER, "AYRSHIRE LASS."

Built by Messrs. Denny Brothers, Dumbarton. Engines by Messrs. Thos. Wingate and Co., White Inch, Glasgow.

	Feet.
Length on deck	88·3
Breadth on ditto, amidships	19·0
Depth of ditto ditto	7·4
Length of quarter-deck	29·2
Breadth of ditto	16·5
Depth of ditto	0·9
Length of shaft space	18·0
Breadth of ditto	1·9
Depth of ditto	3·4
Length of engine room	17·9
TONNAGE.	Tons.
Hull	$91\frac{29}{100}$
Quarter deck	$3\frac{67}{100}$
Total	$94\frac{96}{100}$
Shaft-space	$1\frac{2}{100}$
Engine room	$24\frac{6}{100}$
Ditto, including shaft-space	$25\frac{8}{100}$
Register	$69\frac{88}{100}$

Two inverted cylinder engines, of 16-horse nominal power.

Diameter of cylinders	18 ins.
Length of stroke	2 feet.
Diameter of screw propeller	6 „

3 blades of brass and reversing gear, &c., 1 tubular boiler, 2 furnaces, and 73 malleable iron tubes. Length of boiler 6 ft., breadth 6ft. $2\frac{1}{2}$ ins., height 9ft. 4ins. Tubes, diameter (internal), $2\frac{3}{4}$ins., length 4ft. 6 ins. Furnaces, length, 4ft. 6ins., breadth 2ft. 5ins., height 3ft. 2ins. Consumption of coals per hour, 4 cwt., bunkers carry 14 tons of coals, average 95 revolutions per minute, speed $9\frac{3}{4}$ miles per hour. Frames 18ins. apart, and $2\frac{5}{8} \times 3 \times \frac{3}{8}$ ins. Deck beams, ┬ iron, $4 \times 4 \times \frac{7}{16}$ ins.

Bust female figure head, no galleries, square sterned, and clinker-built vessel, clipper bow, standing bowsprit, 3 masts, latteen-rigged. Port of Girvan. Station, Girvan and Glasgow, &c. Master, James M'Clure.

THE IRON SCHOONER, "SHAMROCK."

Built by Messrs. Denny Brothers, Dumbarton.

	Feet.
Length on deck, new rule	83·5
Breadth on ditto, amidships	20·0
Depth of hold, ditto	11·1
TONNAGE.	Tons.
Register (new rule)	$133\frac{16}{100}$
Ditto (old ditto)	$178\frac{76}{94}$

Distance between frames 18in., 10 strakes of plates, iron keel to gunwale, tapering in thickness, from $\frac{5}{8}$ to $\frac{3}{8}$ of an inch, 4 watertight bulkheads, clipper bow. Launching draught of water, forward, 4ft. 9in.; ditto, ditto, aft, 5ft. $8\frac{1}{2}$ in.; loaded draught, forward, 10ft., aft, 10ft. 6 in.

Bust, man, figure head, no galleries, square sterned and clinker built vessel, 1 deck (flush), standing bowsprit, 2 masts, schooner rigged. Master, Henry Morgan, port of Drogheda. The *Shamrock* was launched on 10th Feb. 1849, and is to be employed in the coasting trade.

ROYAL STEAM NAVY.

DOCK-YARD INTELLIGENCE, &c.

THE ADVANCED STEAM-VESSELS.—The Admiralty have at length fixed the number of the advanced steam-ships, or squadron of reserve, which is to consist of the following vessels:—Portsmouth: *Dauntless, Termagant* (screw), *Encounter* (screw), *Retribution, Phœnix* (screw), *Sphynx, Hecate, Devastation, Birkenhead, Urgent.*—Devonport: *Growler, Salamander, Jackal, Rattler* (screw), *Virago, Spiteful, Conflict* (screw), *Bailisk, Niger* (screw, Hecla. All these steamers are in sea-going order, their boilers and engines in repair, their gun-carriages, &c., on board, and can be got ready for sea in a few hours.

The first engineer of the *Virago*, steamer, is ordered to proceed to Glasgow to superintend the building of a steamer at that port.

WOOLWICH.—A small steam-machine has been constructed for this yard for the purpose of boring the cylinders without taking them out of the vessel. The plan has been found to answer well in private establishments, and has been tried on board the *Sampson.*

MYRMIDON, steam-vessel, when tried down the river on the 9th, made a speed of about 10 knots per hour; and the *Jasper*, when tried on the following day, under the charge of Lieutenant Robertson, a speed of about 8 knots per hour.

FLAMER, steam-vessel, was tried down the river on the 23rd, and found to make an average speed of $8\frac{1}{4}$ knots per hour, she is reported ready for sea.

FIREQUEEN, steam-tender, Master Commander Allen, having had her paddle-floats extended, giving her a greater diameter of paddle-wheel by 8 inches, was tried at the measured mile in Stoke's Bay on the 16th inst., and was said to have attained a speed of $14\frac{1}{2}$ knots.

JANUS, steam vessel, Lieutenant Commander Powell, on her arrival at Portsmouth was tried at the measured mile in Stokes-bay, and went $9\frac{1}{4}$ knots, making $21\frac{1}{2}$ revolutions at a draught of 12 feet 6 inches forward, and 13 feet 7 inches aft.

THE GARLAND, DOVER MAIL PACKET.—On the 12th inst. the Dover mail steam-packet *Garland*, was tried down the river, after a refit at Woolwich. The result of six runs at the measured mile in Long Reach gave a mean speed of 13·363 knots, or 15·394 statute miles. The engines made $33\frac{1}{2}$ to $34\frac{1}{2}$ revolutions a minute, and the quantity of coals and spare gear belonging to herself, and some for the other Dover packets, brought her to her load water line, viz., 6-ft. 8-inches forward, 7 feet aft. On her return, she fell in with the *New Star*, Gravesend boat, and in a run from Erith to Woolwich proved to be of exactly the same speed, or, if a differ-

ence, in favour of the *Garland*. From 27th of May, 1846, to the 16th of December, 1848, the *Garland* has steamed 25,139 nautical miles, or 28,960 statute miles. The *Garland* was built by Messrs. Fletcher, from the drawings of Mr. O. Lang, Jun., of Chatham, and her engines are a pair of 60's with oscillating cylinders, and feathering paddle-wheels, by Messrs. Penn.

Relative Speed of the Holyhead Mail Steamers.—Commander Charles Fraser, R.N., superintendent of the Holyhead Mail Steamers, has certified the speed of these vessels during the month of February last, as follows:—

Name.	No. Trip.	Shortest trip and weather.	Longest trip and weather.	Average.
Banshee......	13	3 h. 35 min. W.N.W. lt. breeze.	4 h. 27 min. W. strong breeze.	3 h. 54 min.
Llewelyn...	14	3 h. 37 min. S. S. W. breeze.	4 h. 15 min. W. fresh gale.	3 h. 57 min.
Caradoc.....	19	4 h. 1. min. W. S. W. breeze.	5 h. 20 min. W.N.W. sg. breeze	4 h. 20 min.
St. Columba	10	4 h. 8 min. W.N.W. finebreeze	5 h. 5 min. Strong gale.	4 h. 29 min.

Armament of Steam Vessels.—The following instructions have recently been issued in reference to the armaments of steam-vessels and ships of war: 1. All 8-inch and 10-inch guns carried on the upper decks of steam-vessels as broadside guns may be mounted on slides and carriages.—2. 56-pounder guns are not to be used in any of the ships or steamers in the navy except the Terrible whose extreme rake fore and aft and great breadth of beam render them suitable. The armament of the *Blenheim, Ajax, Edinburgh*, and *Hogue*, has been changed, and is to consist of the following: lower-deck, 28 32-pounders of 56 cwt.; main deck, 26 8-inch guns of 52 cwt.; upper deck, two pivot 68-pounder guns of 95 cwt., and four 10-inch guns of 85 cwt.—The armament of the *Eurotas, Forth, Horatio*, and *Seahorse*, has also been changed to the following: main deck, eight 32-pounders of 56 cwt., and 12 8-inch guns of 52 cwt,; upper deck, two pivot 68 pounder guns of 87 cwt., and two 10-inch gun of cwt.

The use of copper lining to magazines of ships fitted to receive Dell's patent powder cases is to be discontinued.

House of Commons, March 16.—Mr. S. Herbert remarked, in answer to Sir W. Molesworth, that having been in office when measures for establishing the present Steam Navy were commenced, he must deny the allegation of the hon. member, that twenty-one war steamers had been ordered at one time. The whole of those vessels were for the packet service, and although professional men were disagreed as to the eligibility of iron for war steamers, yet every packet company in England was gradually adopting iron steamers. The other six iron vessels referred to were war steamers. The hon. baronet was not justified in asserting that the iron war steamers had turned out complete failures. Two experiments only had been tried with respect to those vessels, one at Woolwich and the other at Portsmouth. That at Portsmouth was made upon an old hull, so rusty that a walking-stick might have been pushed through it. (*Vide* Artizan, last No.) The experiment at Woolwich had been fairly tried, and had given a favourable result. There were only two officers in the navy who had had any practical experience of the capabilities of iron vessels; both those officers had had iron vessels in action, and had reported very favourably of them. The hon. baronet had stated that the *Terrible* was a remarkably slow ship because she could not sail sixteen miles an hour. He had seen many vessels in the Mediterranean last year, but none that could surpass the *Terrible*. The only person who ventured to assert that any vessel could sail faster, was an American captain, who boasted that his own ship could beat her, but who, when asked to give an opportunity to decide the point, said it would be dangerous to make his vessel sail as fast as she could go. Comparisons had been drawn between ships built in the dock-yards and in private yards, much to the disadvantage of the former, and the vessels built by Messrs. Wigram and Green, in particular, were held up as models. Now, it happened that every one of those eminent builders' ships was copied from the *Inconstant* frigate, which was built on the lines of Admiral Hayes, in one of our dock-yards. Instead of the ships of the navy being built, as was alleged, by *dilettanti* amateur shipbuilders, they were constructed by the most experienced practical shipwrights. (On the intuitive system?—Ed.)

Mr. S. Herbert has since retracted his statement respecting the lines of the *Inconstant*, which Mr. Green states he never saw, and certainly never copied. *The Times*, however, gives the subject such a clincher that we cannot refrain from quoting it—"Comparisons," continued the ex-secretary, in the ardour of his apology, "have been drawn between ships built in the dock-yards and in private yards, much to the disadvantage of the former." They certainly have, and if the conclusions can be disproved, Mr. S. Herbert will have done much for his official renown. He urges accordingly, that Messrs. Wigram and Green had laid down every one of their ships upon the lines of a royal frigate. Their selection for this purpose was the *Inconstant*, and highly does the choice speak for their skill. But what Mr. Sidney Herbert either could not or would not see, or in his precipitancy overlooked, is, that this one simple fact involves the utter condemnation of those very practices in defence of which it was quoted. There is no doubt that the *Inconstant* was a capital ship, and when Messrs. Wigram & Green had found her so to be, *they adhered to the model*. Why did not Mr. Sidney Herbert's friends do the same? How many frigates have been built, unbuilt, discontinued and broken up, for mere experiment's sake, *since* the *Inconstant* was ascertained to be so admirable a model? This is the identical distinction between public and private yards, which has been so emphatically denounced. Messrs. Wigram & Green, like prudent managers, cast about for the best model. When they found it they were content, and "*every one* of those eminent builders' ships," as the ex-secretary innocently confesses, was built upon this very plan, so that all the risk and cost of experiments were terminated at once and for ever. Our dock-yard authorities did nothing of the sort, but continued their experimental vagaries just as if the *Inconstant* had never been laid down. So much for the official defence of a system at length exploded."

The Niger steam sloop went down the river on 19th instant for trial under the charge of Lieut. Robertson, Capt. Halstead, Capt. Hyde Parker, Capt. Spencer, and several of the officers studying steam at Woolwich factory. Mr. Humphries, chief engineer at Woolwich dockyard, Mr. Smith, Mr. Field, the constructor of the engines, were on board, and she proceeded as far as the Mouse light; when tried between the Nore and the Mouse light, her speed was found to average 9.494 knots, her engines making very nearly 69 revolutions per minute.

Friday, March 16.—Steam Vessels.—Sir H. Willoughby wished to ask the First Lord of the Admiralty if six steam vessels, the *Myrmidon*, the *Torch*, the *Zephyr*, the *Otter*, the *Adder*, and the *Dotterell*, have been sold, and if sold, for what sum, and to whom, and if such sale was by private contract or public auction. Sir F. Baring said the vessels had been sold in consequence of the purposes for which they had been used having been put an end to by alterations at the ports of Holyhead and Harwich. He had no objection to lay the papers on the subject before the House.

(These vessels have been sold to the parties who have contracted to carry the mails from Harwich.)

STEAM NAVIGATION.

LOSS OF THE FORTH.

The Royal Mail steam-packet *Forth*, 1814 tons, 500 horse power, (the first steamer belonging to the Royal Mail Steam Packet Company that left England for the West Indies), *en route* from Havannah to Vera Cruz, was totally wrecked on the Alacran Reefs, on Sunday morning, January 14, having been swept out of her course by one of those violent and deceptive currents so much dreaded and so little understood even by those whose lives are spent in navigating these waters, and which seem at once to set at defiance the utmost skill and vigilance exerted to combat them.

The *Forth* started from St. Thomas's on the 2nd of January, where she had received mails, passengers and cargo, from the *Avon*, made a quick passage to Jamaica, took in coals there, and proceeded with all dispatch to Havannah, where she arrived on the 11th.

She steamed away the following day at 8 a.m., all sail set, going 8½ knots an hour; by 12 o'clock the following day the distance run was 205 miles; our latitude 22 deg. 56 min., long. 86 deg. 40 min., the south part of the

Alacranes then bearing S., 79 deg., W. 175 miles. At 2h. 20m. p.m., lat. 22 deg. 50 min., long. chronometer, 86 deg. 59 min. 30 sec., south part of Alacranes bearing S. 80 deg., W., 154 miles. At 8h. 50m. p.m., latitude by Aldebran 22 deg. 33 min. N., latitude by dead reckoning 22 deg. 36 min., longitude 87 deg. 55 min. south part of the Alacranes, bearing 82 deg. 33 min. W., distance 100. At 11h. 4m. p.m., lat. by Sirius, 22 deg. 29 min., lat. by dead reckoning, 22 deg. 29 min., long. 88 deg. 17 min. south part of the Alacranes, bearing S. 85 deg. 58 min. W., distance 85 miles. At 5h. 5m. a.m., the time the vessel struck, the lat. 22 deg. 15 min. north, long. 89 deg. 11 min. W., south part of the Alacranes bearing N. 73 deg. 49 min. W., distance 29 miles. The actual latitude of the spot on which she struck is 22 deg. 26 min., long. 89 deg. 38 min., which makes the current she experienced since 11h. 4m. p.m., N. 66 deg., W., 27½ miles, equal to 4½ knots an hour. A cast of the lead was taken at 8 p.m., no bottom at 21 fathoms; at midnight no bottom at 31 fathoms; and was likewise taken every four hours.

It will be observed by these statistics that every precaution was taken to ascertain the position of the vessel, and ensure her safety, and that the captain was fully alive to the danger of the navigation, and that the vessel in six hours had experienced a current of 27½ miles.

At five minutes past five a.m., on the 14th, the officer of the watch observed breakers a-head. He immediately ordered the helm to be put hard a starboard to endeavour to clear them, but there being no chance of her doing so, he stopped her, and turned astern. She then struck on her starboard bow. The captain finding her head come up and going off to seaward, ordered the starboard head braces to be hauled in to "box her off," and turned a-head full speed. The depth of water under her stern was 2½ fathoms. The chief engineer now came upon deck and informed the captain that the blow-off pipes were broken, and that he could not keep water in her boilers; on which the captain ordered him to stop her, and blow the steam off before the men left the engine-room—thus avoiding the too-commonly-practised error of getting a sinking vessel into deep water. Had he persevered, the vessel would have gone down in 32 fathoms of water, and in all probability every soul on board would have been sacrificed.

Seeing no chance of now saving the vessel, they took to the boats, and the starboard life-boat having been lowered, about 80 people got into her under the command of the fourth officer. The port life-boat and gig both got adrift, and were swamped; the quarter cutters, however, were fortunately launched, the remainder jumped into these boats. The only question now was, whether the gap in the reefs would allow the boats a passage to the Island of Perez, distant seven or eight miles. This difficulty was soon solved by Lieutenant Molesworth, a passenger proceeding to the *Wellesley*, who, in one of the cutters, gallantly pulled through, and was soon followed by the others, and they reached the island in an hour or two. Here they found a brigantine. They at anchor were greatly assisted by the boats of a schooner anchored near the reef when the *Forth* struck. The next and following days, trips were made from the island to the vessel; everything having been saved that could, they set sail on the 17th in the brigantine for Sisal; here not being able to find a vessel, they proceeded to Campeachy, where the American schooner *Lily* was chartered to convey the passengers and part of the crew to Havannah. The *Lily* not being able to sail before the 21st, the captain dispatched an officer in a small schooner with intelligence to Havannah to ensure the stoppage of the English steamer. After being driven about by gales of wind and violent currents from the 21st, the *Lily* arrived at Havannah on the 5th of February, when it was discovered that the small schooner had not made her appearance, so that both of the Royal Mail steamers had sailed, one for the Gulf of Mexico, the other for Jamaica, and the European mails were waiting for the *Forth* to convey to England: they have since been forwarded *via* America.

From the moment that the vessel struck, it is said that no men could have behaved better than the crew of the *Forth*. Sailors, firemen, coal-trimmers strived for emulation in rendering themselves serviceable. Not a single instance of insubordination occurred. Orders were received with the same respect and executed with the same promptitude as they would have been had the vessel been at sea, and considering that spirits and wine were got at, and that loose bottles of both from broken cases were distributed about in all directions—every praise is due to them, that not a single case of intoxication occurred. The captain very wisely ordered that none should be saved, and the officers were very assiduous in throwing away all that came under their observation. Owing to this, and to the unanimity of purpose and good order, was it that so many things were saved, and that no accidents happened.

The *Forth* was built by Messrs. Menzies and Co., in 1841, at Leith, and had made sixteen successful voyages to the West Indies. It is worthy of remark that Mr. J. B. Rowland, her surgeon, was wrecked on the same spot in the ill-fated *Tweed*, and it was this gentleman's graphic account of the wreck that excited so much interest at the time of this unfortunate occurrence. Mr. Wilson, Mr. Nunn, and Mr. Higman, left Southampton as the first, second, and third officers of the *Forth*; Mr. Angus, chief engineer; and Mr. A. H. Strutt, purser.

The passengers presented Lieutenant Molesworth with a highly complimentary letter for his gallant conduct, to which the safety of the whole of the passengers' lives is to be mainly attributed.

The Severn has come home in place of the *Dee*, in consequence of having broken off her starboard paddle-wheel shaft close to the ship's side. The run from Bermuda to Southampton has been accomplished with only one wheel, but has nevertheless occupied only 13 days 12 hours—a remarkably quick passage under the circumstances.

Avon, Captain Hast, R.N., met with a precisely similar accident as the *Severn*, on the 19th of January, having broken her shaft on the same side and in the same place, soon after leaving Demerara. She arrived at St. Thomas on the 29th, and would wait for the next homeward mails from Chagres, *via* Jamaica, &c., coming home with the use of only one paddle-wheel. These accidents to two sister ships are very singular, as both vessels have been performing Atlantic voyages for the last six years without the slightest sign of weakness in that part of the machinery.

Sale of the Great Britain Steamer.—The leviathan screw-steamer *Great Britain* has, within the last few days, changed owners. It is rumoured that she has been purchased by a company who intend to carry passengers between some point on the western side of South America and San Francisco. The sum she realised is said to be £25,000.

The Oronoco Steam Navigation Company.—About eighteen months ago the Venezuelan Government granted to Mr. Vespasian Ellis, the United States chargé d'affaires at Venezuela, the exclusive privilege of navigating the Oronoco by steam. This gentleman proceeded to the States, and immediately formed a company, with a subscribed capital of 300,000 dollars. The first of this company's boats, the *Venezuela*, of 700 tons, and 250 horse-power, United States build, arrived in the harbour of the port of Spain, on the 17th January, to the no small amazement of the inhabitants of that place. She is the first of four that are intended to be put on the river to trade between Bogota and the mouth of the Oronoco, a distance of 1,500 miles. Having mentioned Mr. Ellis as the projector of this company, it is necessary to state, under the circumstances of the adjacent state of Venezuela being in civil war, that in consequence of that gentleman having acted as the agent of General Paez, in the purchase of a steamer called the *Scourge*, the company, wishing to avoid being mixed up with the party politics of the country, ousted Mr. Ellis from the presidency, and elected another shareholder in his place.

Royal Arsenal, Woolwich, ~~March 20.~~—Experiments were carried on yesterday and to-day at the butt in the Royal Arsenal, to test the merits of a musket ball submitted to the select committee by Dr. Minesinger, an American by birth, but of Dutch origin. The ball is cast with a four-grooved tail attached to it, in length about three-fourths the diameter of the spherical portion, the tail resembling the first screw propellers introduced with 4 leaves, but with a slight obliquity, instead of the Archimedian screw form. Mr. Minesinger fired his ball, 23 to the lb., from a long-barrelled gun, 5ft. 7in. long, and Col. Dundas, C.B., from a common musket, the barrel of which was 3ft. 3in. long, both guns having percussion locks. The firing commenced at 100 yards, but, after a few rounds by each, the distance was extended to 200 yards, when excellent practice was made, the target being struck every time with two or three exceptions. The appendage to the ball gives it similar advantages to a ball projected from rifles, and considerably increases the range; and should it, on further trial, be approved, every common musket, by its adoption, would possess the projective power and excellent direction at present only obtained with any degree of certainty by grooved rifles. It is intended to have a number of 32-pounder solid shot and shells cast on the same principle, for trial in the marshes.

March 22.—The experiments have been continued, the range being extended to 300 yards. Previous to concluding the firing at 200 yards range, Colonel Dundas made a number of excellent shots, striking the target every time, with balls of the sugar loaf pattern, submitted by Mr. Lancaster, jun. These balls were fired from a beautiful rifle of French pattern; and, by a very simple appliance, are made to fit quite tight in the rifle without wadding. A small groove is cut round the sugar-loaf shaped ball near the base, and two or three worsted threads tied round and raised beyond the diameter of the base to the extent required. The long-barrelled gun used by Mr. Minesinger contains a space for a chamber at the breach end of the barrel, and he loads his chambers before he commences firing, and fires five rounds before he again charges the five chambers he carries in his pocket. The gun, consequently, requires no ramrod, a small piece of wood and a stone from the ground being sufficient for driving home the powder and balls in the chamber, which is only three inches in length. Each chamber has a projecting nipple on which the percussion cap is placed, and is held securely to the stock by a sliding hinge, and is capable of firing 20 rounds per minute.

British and North American Royal Mail Steam-ship Company.—This company have now in a forward state of construction, on the banks of the Clyde, two new steamers, to be named the *Asia* and *Africa*. They are intended to fill the place of the *Britannia* and *Acadia*, which have recently been sold to the German Government, and have been fitted up as war steamers in the Coburg dock. The new steamers will be commanded by the oldest officers of the company, Captain Judkins and Captain Ryrie, who will be succeeded in the charge of their respective vessels, the *Canada* and *Niagara*, by Captain Harrison and Captain Shannon, and in like manner they will be succeeded by the captains next in seniority in the service. In the command of the *Europa*, however, there will be no change, Captain Lott, no doubt feeling justly proud in retaining the control of his crack steamer, upon the merits of which and those of her sister ships the many encomiums by the English and American press are richly deserved. The *Caledonia*, one of the first of the company's vessels, may shortly be expected to arrive in the Mersey from the Clyde, where she has been undergoing a thorough overhaul both in hull and machinery. Her boilers have been renewed entirely on the principle of those she had before, and which have given so much satisfaction, both as regards keeping up a plentiful supply of steam, of being light, and of consuming a small proportionate quantity of fuel, while her engines have received new bushes and other little requisites so as to make them as good as new. The overhaul of the *Caledonia's* hull, although by no means absolutely necessary, extended to entirely new wood-sheathing of three inches thick, with copper-sheathing above that on the bottom, and new ceiling within the hull, as well as a number of extra iron stays, knees, and copper bolts.

The *Acadia* had a very narrow escape of being totally lost on her run out, having gone on shore on the coast of Holland. She has since however been got off, without much damage.

ANALYSIS OF PATENTS.

William Watson Pattinson, of Felling, near Gateshead, Durham, chemical manufacturer, *for improvements in the manufacture of soda.* Patent dated January 27, 1848.

This invention relates principally to the method of making soda from common salt. The improvements consist in employing machinery to keep the products constantly stirred during the various processes, an operation which has hitherto been only imperfectly performed by hand. As it is necessary to keep the stirrers and scrapers cool, the shaft and arms are made hollow, so as to allow a current of cold water circulating through them, and carrying off the heat to which they are exposed.

Thomas Gill and John Edgecumbe Gill, of Plymouth, manufacturers, *for improvements in the manufacture of manures.* Patent dated 8th April, 1848.

This invention consists in certain methods of treating bones and similar substances, with sulphuric, muriatic, nitric, and acetic acids, assisted by heat, to produce manures in a granulated state.

John Ashbury, of Openshaw, near Manchester, *for certain improvements in the construction and manufacture of wheels, for use upon railways and common roads, and in the methods of preparing and constructing the tyres used thereon.* Patent dated 11th March, 1848.

This invention consists, first, in various combinations of cast and wrought iron and wood, in constructing wheels, whereby greater strength and elasticity are attained; secondly, in connecting the tyre to the rest of the wheel without heating it, and shrinking it on; in various methods of constructing and fixing the tyres; and, lastly, in rendering the wooden portion of the wheel incombustible by any of the usual processes.

John Ecroyd, of Rochdale, Lancashire, machine-maker, and John Eccles, of the same place, mechanic, *for certain improvements in valves or plugs for the passage of water.* Patent dated April 10, 1848.

These improvements in valves consist, first, in forming them of a disc faced with leather, and brought in contact with a metal seat by means of a screwed spindle, thereby closing the passage. Provision is made for the escape of the water left in the valve casing, by making the thread of the screw smaller in diameter than the nut in which it works, in order to prevent injury from the water freezing. Another arrangement is also described, in which a hinged valve is raised by an endless screw working in a toothed segment on the valve.

David Davies, of Wigmore-street, Cavendish-square, coach-maker, *for certain improvements in the construction of open and close carriages.* Patent dated April 15, 1848.

This invention consists of an improved method of forming the heads of carriages, so as to admit of their being thrown completely back, out of the way of those sitting inside. On each side of the door of the carriage are pillars, to the tops of which are jointed the back and front heads, the tops of which are also half-jointed, to turn back upon the other part; the hinge joints are fitted with guide pieces and stops to insure steadiness.

Samuel Clegg, of Regent's-square, Middlesex, engineer, *for improvements in gas meters.* Patent dated 20th April, 1848.

These improvements consist, first, in making the internal drum of a wet meter watertight, so that by its buoyancy the weight upon the bearings of the revolving drum, and, consequently, the friction, may be diminished; secondly, in registering the total quantity of gas passing through the meter, by only measuring a part thereof, the relative proportions of the apertures through which the two quantities of gas pass being known. But, inasmuch as the gas which moves the meter has to overcome the friction of the moving parts, a compensating apparatus is described, by which, when the pressure varies, the two apertures are rendered more nearly equal in size, and the flow of gas regulated.

Edward Walmsley, of Heaton Norris, Lancashire, cotton spinner, *for certain improved apparatus for preventing the explosion of steam-boilers.* Patent dated 27th April, 1848.

This invention consists in apparatus for lifting the safety-valve of a boiler, and admitting a current of cold air into the furnace, or closing the damper, when steam exceeds a certain pressure, or when the water in the boiler falls below a certain level. For low pressure boilers the patentee attaches an apparatus to the feed head, by means of which the water, when raised above its due level, runs over, and into a scale pan, which it forces down, and by suitable connections opens the safety valve. There is a valve at the bottom of the pan, which allows the water to escape when it has done its duty, and the pan to re-assume its position. For high pressure boilers the patentee proposes to use a loaded valve instead of the column of water. [This patent reminds us of the book, which was stated by the reviewer to contain much that was good and much that was new; but, unfortunately, what was good was not new, and what was new was not good. In low pressure boilers the feed head is so effectual as to want nothing else, and in high pressure boilers the patentee proposes to make one safety valve open another. We fear that the idea of two safety valves to one boiler is hardly new enough to warrant the expense of a patent.—Ed. *Artizan.*]

Henry Henson Henson, of Hampstead, Middlesex, gentleman, *for certain improvements in railway carriages and waggons, and in vessels of capacity employed in the storing and conveyance of explosive substances.* Patent dated 15th April, 1848.

THE first section of these improvements comprises various methods of forming railway wheels, of wrought iron entirely, and of wrought iron in combination with wooden spokes; in finishing the tyres of wheels by hammering instead of turning; in the introduction of gutta percha between the tyre and the wheel to diminish the concussion. The second part comprises various improvements in the construction of the axles; in combining steel and wrought iron in the axles; in connecting the wheels by a large wrought iron tube, in addition to, or in lieu of, the ordinary axle, and in forming the wheels with deep bosses, allowing them to run loose upon the axles in applying a collar of vulcanized India rubber between the boss of the wheel and the axle collar. The third part comprises various arrangements for bearing, buffer, and drawing springs, air being used either alone, or in conjunction with a diaphragm of vulcanised India rubber; in forming bearing springs of a single tapering girder with top and bottom flanges, and in conical spiral springs. The fourth part consists of certain improvements in waggons, the framework being composed of wood, Paynised, or otherwise rendered fireproof, and sheet iron. It is also proposed to protect them from the weather, by a tilt of gutta percha drawn over the waggon;—revolving iron shutters for the openings of the waggons are also proposed. The fifth part consists of an improved method of constructing magazines for the transport of gunpowder, &c. The magazine is to be constructed of copper, surrounded by a space which may be filled with water or carbonic acid gas. An apparatus is described for extracting small quantities of powder, consisting of a sliding tube, dipping into the powder through a socket, by which means all danger of fire communicating to the interior of the magazine is obviated.

Matthew Cochran, of High-street, Paisley, Renfrewshire, *for certain improvements in the production of coloured patterns, or designs, on warps of carpet, velvets, or other textile materials, parts of which improvements are applicable to the production of coloured patterns or designs on woven fabrics, or other plain surfaces.* Patent dated 20th April, 1848.

As it would be difficult to give the details of this machinery without drawings, we must content ourselves with giving the patentee's claims. First, the arrangement of apparatus for colours for printing various materials; secondly, the production of coloured designs, or patterns, upon yarns or threads, by immersion in the colour, in place of printing the colours upon such yarns or threads, by means of blocks, plates, or rollers, as usually practised; thirdly, the construction of immersing apparatus, working in conjunction with the ordinary jacquard apparatus, or with the ordinary drawing simple, as employed in harness, weaving, or any other apparatus capable of producing a pattern or design; fourthly, the arrangement of operation of each row of the impressers by means of a separate card; fifthly, the method of printing several colours at one time upon different lines of pattern, by the use of cards perforated with several rows of holes, each row being employed for each separate colour; sixthly, the printing of several colours at one time on separate lines of the pattern; seventhly, the method of printing cloth, or other close-textured material, by means of impressers, in connexion with jacquard apparatus, or other similar apparatus, capable of producing a design or pattern.

John Brittern, of Birmingham, machinist, *for certain improvements in heating, lighting, ventilating, and closing and screwing the doors of apartments; also in lighting and ventilating carriages; parts of which improvements are applicable to other like purposes.* Patent dated 20th April, 1848.

THE first part of this invention consists of an arrangement of stove doors composed of glass in strips; secondly, of a method of ventilating an apartment by supplying a close fire-place with air taken from the top of the room: thirdly, of a new form of gas-burner; fourthly, of a guard to be placed on a candle, to prevent it from guttering by draughts of air, the guard sinking as the candle is consumed; fifthly, of improvements in carriage windows, which are to open like a pair of doors; the rest consisting of various schemes for the springs, locks, and latches of doors, the locks being so constructed that they may be locked without the opening key.

William Henry Barlow, of Derby, civil engineer, and Thomas Forster, of Streatham Common, Surrey, gentleman, *for improvements in electric telegraphs, and in apparatus connected therewith.* Patent dated 27th April, 1848.

THE first of these improvements consists in the apparatus for coating the wires with gutta percha, being a series of rollers, heated by steam, through which the wire and gutta percha are drawn, and, by the operation of the heat and pressure, the covering of gutta percha is completely formed on each wire. The second part consists of an apparatus which may be employed either for bringing up the type in a printing telegraph, or for communicating intelligence by a hand or pointer on a dial. A movement of the pointer is obtained by a pair of differential wheels, actuated by a maintaining power, so that when released by the action of the current of electricity, all the necessary signals may be made by the various combinations of the partial revolutions of the wheels. The same apparatus is adapted to a printing telegraph to bring up the type-wheel to its proper position for each letter. The signalling apparatus consists of a clock, the moving disc of which is provided with sixty moveable pins, one of which, according to the time at which the train passes, is pushed out by the agency of an electro-magnet in telegraphic connection with the station, from whence the times of the passing trains are to be indicated. The distance which the pin has been carried from a given point, will indicate how long the train has passed the distant station, and therefore at what time it may be expected.

John Masters, of Leicester, gentleman, *for improvements in dress fastenings and in attaching the same, and in articles made wholly, or in part, of certain flexible materials or fabrics.* Patent dated April 12, 1848.

This invention relates to various methods of making buttons, and of using vulcanized india-rubber in ladies' dresses, and a variety of other articles too numerous to mention, one of them being a fictitious top for a short boot, giving the appearance of a Wellington boot.

Roger George Salter, of Birkenhead, in the county of Chester, Surveyor, *for certain improvements in carts for the distribution of liquid substances, and in the construction of drains, sewers and cesspools; and in the cleansing of the same.* Patent dated April 27th, 1848.

The first part of these improvements consists in regulating the supply of liquid to the distributing apparatus of the cart, by passing it through a pump worked by the wheels of the cart so that the supply may be in proportion to the speed of the cart. The second part consists of a self-acting flushing apparatus, in which the head of water is maintained until it has reached a certain height, when it flows down a pipe and acting on the extremity of a lever, opens the valve and allows the whole body of water to escape for the purpose of flushing the sewer, &c.

James K. Howe, of New York, in the United States of America, *for improvements in building ships and other vessels.* Patent dated 27th April, 1848.

THE patentee claims the constructing hulls of ships, or other vessels, of regular curves, being portions of circles, so that on this plan the whole of a vessel's lines may be determined by the aid of a pair of compasses, a remarkably *simple* way, it must be confessed, of getting over a subject of acknowledged difficulty.

George Remington, of Warkworth, Northumberland, civil engineer, *for improvements in locomotive engines, and in marine and stationary engines* Patent dated May 26, 1848.

This invention relates to a method of converting reciprocating rectilineal motion into rotatory motion, and *vice versa*, and consists of various modifications of the slotted cross head, in which a block on the crank pin works. A new method is also described of forming the connection between the eccentric rod and the reversing gear of an engine. (If this gentleman had condescended to ask the advice of any practical engineer before he took out this patent, he might have been saved the expense of patenting an arrangement which is as old as the hills, and quite inadmissible in anything but a "donkey" engine.—Ed. *Artizan.*)

Daniel Rice Pratt, of Worcester, in the State of Massachusetts, America, *for machinery for connecting railway carriages.* Patent dated April 27, 1848.

This invention consists of a self-acting coupling, so that when the carriages run together they become connected. It consists of a draw bar with a hollow link, which raises a circular hook, which, on falling, prevents the link from being withdrawn.

Isaac Hartes, of Rosedale Abbey, Yorkshire, farmer, *for certain improvements in machines, or machinery, for rowing, sowing, and manuring land.* Patent dated May 2, 1848.

This invention relates to machines for sowing and manuring land in such a manner that the manure and the seed shall fall to the ground in successive portions, and not in one continuous stream, as is usually the case in machines of a similar description, the manure and the seed being carried down the same spout and deposited in the ground simultaneously. This machine is to be drawn by animal power, but is not provided with any apparatus for preparing the ground or making furrows. A set of mould boards follow the seed distributors to cover up the manure and seed as deposited.

Henry William Schwartz, of Great St. Helens, London, merchant, *for improvements in steam engines.* Patent dated 4th May, 1848. (Communication.)

We think it will be sufficient to say of these improvements (?) that they consist, as well as we can make out, in placing a small cylinder above a large one, the steam being first admitted into the small one, and afterwards into the large one, (an infringement of Mr. Sims' patent so far), the lower piston however, is acted upon by the atmosphere on its underside, and not being allowed the luxury of a piston rod, is to suddenly jump up, and do something, but what, we cannot spare time to find out; but the patentee tells us that it is impossible to conceive the power to be obtained from having the piston loose, in the truth of which we quite agree with him.

Edward Haigh, of Wakefield, plumber, *for an invention for measuring water, or any other fluid.* Patent dated 9th May, 1848.

The patentee claims the construction of a machine or apparatus for measuring liquids, consisting of a preparatory cistern, in connection with a drum or wheel provided with two series of chambers, into which the liquid to be measured enters alternately and in succession from the preparatory cistern, such drum or wheel being supported by a lever or regulator, the drum or wheel being filled and made to revolve by the liquid, as described.

William M'Lardy, of Salford, Lancashire, manager, and Joseph Lewis, of the same place, machine maker, *for certain improvements in machinery, or apparatus applicable to the preparation and spinning of cotton, wool, silk, flax, and other fibrous substances.* Patent dated May 9, 1848.

The inventors propose to make the spindles of slubbing and other frames in two parts, to facilitate the doffing of the bobbin, and to obviate the necessity of having new spindles when their bearings are worn, by forming them of hoops of steel, which can be replaced as they become worn.

Lewis Dunbar Gordon, of Abingdon-street, Westminster, civil engineer, *for an improvement or improvements in railways.* Patent dated May 9, 1848.

The first part of this invention consists in forming the ends of the rails in such a manner that the end of one shall rest upon the end of another, being made with an underlap joint to prevent the end from rising, as is commonly the case. The second part consists in forming the sleepers of wrought iron plates, curved to form an arch, on the top of which the chair is fixed, by being cast on. The third part, of a method of strengthening the rail at the joint by means of a trough or other girder of wrought iron. The fourth part consists of an improved method of fixing the rails in the chairs. A slot and recess being cast in the chair to admit of a nut, through which passes a bolt, the point of which presses against the wooden key or other packing on the rail. When wooden keys are used, the patentee proposes to treat them with a varnish of boiled oil and red lead, which will render them less susceptible of atmospherical changes without impairing their elasticity.

Vincent Price, of Wardour Street, Soho, Middlesex, machinist, *for certain new or improved mechanical arrangements for obtaining and applying motive power.* Patent dated May 11th, 1848.

The first of these improvements consist in substituting a ratchet wheel and gear for the crank in certain situations—Secondly, in various forms of machines for chopping and slicing meat, turnips, &c., and in applying the force of currents of water passing through pipes laid in a ship's hold, for working the ship's pumps and other purposes.

Moses Poole, of the Patent Office, gentleman, *for improvements in propelling vessels.* Patent dated May 26, 1848.

These improvements consists in a new form of propeller, called by the inventor, Lieut. Col. Sir F. Livingstone Mitchell, the "Boomerang Propeller," from the similarity which is stated to exist between its action, and the flight of the boomerang through the air.

William Taylor, of Birmingham, machinist, *for an improved mode of turning up, or bending flat plates of malleable metals, or mixture of metals, by the aid of machinery, into the form of tubes.* Patent dated May 18, 1848.

The patentee describes an improved machine for making lap-welded, or butt-jointed tubes, on a mandril. The machine consists of a sliding table, driven along its bed by a rack and pinion, as in a planing machine, and on the table is fixed a longitudinal die, part of a circle in section, of the size of the outside of the tube to be made. A roller, the periphery of which corresponds with the inside of the tube, revolves over the die, and the plate of metal to be turned up into a tube, passes first between this roller and the die on a mandril in the centre. The tube next passes under a pair of conical rollers, placed obliquely, by which the sides are turned over, and the joint may be then closed, either by soldering or welding.

George Henry Bursill, of Albany-place, Hornsey-road, James Paterson, of Baldwin-street, City-road, and John Matthews, of Norman's-buildings Old-street, engineers, all in the county of Middlesex, *for a certain improved method, or methods, of treating malt liquors, or other liquids or fluids, and certain improvements in machinery, or apparatus for effecting such improved method or methods of treatment.* Patent dated May 22, 1848.

These improvements consist in arranging the beer-engine in such a way that when the beer is drawn, a certain quantity of carbonic acid gas shall be drawn along with it, the beer becoming impregnated with the gas by the pressure to which they are subjected, in their passage from the vessels in which they are stored.

Alexander Southwood Stocker, of York-place, City-road, Middlesex, gentleman, *for certain improvements in time teachers and boxes, show cards, holders, for matches, pens, pins, or needles, and other articles; and in the mode or modes of manufacturing the same.* Patent dated May 4, 1848.

The first of these numerous improvements consists in making the hands of a time teacher elastic, so that when moved to any particular point round the clock face, by which children are taught the use of clocks, they shall remain there by reason of their elasticity. The remaining improvements are of much about the same value.

Charles Hancock, of Brompton, Middlesex, gentleman, *for certain improved preparations and compounds of gutta-percha, and certain improvements in the manufacture of articles and fabrics composed of gutta-percha, alone, and in combination with other substances* Patent dated May 11, 1848.

The first of these improvements relates to the method of manufacturing shoes or goloshes. Moulds are constructed into which the fluid gutta-percha is poured, to form the sole and upper part of the shoe in one piece, and this plate of gutta-percha is to be worked by hand on to a last of the required shape, the last being previously covered with stuff to form the lining of the shoe, and the exterior of the lining being coated with a solution of gutta-percha, or caoutchouc, to cause adhesion. The second part consists of various methods of forming the backs of brushes of gutta-percha, or of gutta-percha in combination with other materials. The third part consists in forming a compound of gutta-percha, caoutchouc, and gold oil size, for the purpose of making a compound which shall serve as a vehicle for the colours in painting and printing upon gutta-percha. The fourth part consists in forming various compounds of gutta-percha and resin, or shellac and borax, for coating the wires of electric telegraphs, waterproofing articles, &c.

Abraham Solomons, of Basinghall-street, London, merchant, and Bondy Azulay, of Rotherhithe, printer, *for certain improvements in the manufacture of gas, tar, charcoal, and certain acids.* Patent dated May 26, 1848.

These improvements consist in employing the heat of high-pressure steam to effect the destructive distillation of wood, and other vegetable substances, in various states. The substance to be carbonized is placed in a retort, of a construction suited to the nature of the substance, and is to be exposed to the direct action of the steam, the gaseous products being collected and purified by any of the well-known and suitable arrangements for that purpose.

Thomas Burdett Turton, of Sheffield-street, manufacturer, *for certain improvements in machinery for bending or fitting plates or bars of steel, iron or other materials, to be used for locomotive engine and carriage springs, and other purposes.* Patent dated June 1, 1848.

The machine, described by the patentee, bears a strong family likeness to a common boiler plate bending machine, consisting of three rollers, but placed in a vertical, instead of a horizontal position, and being overhung. The shifting roller, the position of which determines the curvature of the plate, is mounted at one end of a lever, on the other end of which is mounted a swivelling nut, through which a screw, moved by hand, works, and brings the roller up to the desired position.

LIST OF ENGLISH PATENTS.

From 16th February 1848, to 14th March 1848, inclusive.

Charles Thomas Pearce, of Park-road, Regent's Park, Esq., for improvements in apparatus for obtaining light by electric agency. Patent dated February 16; six months

Charles Frederick Whitworth, of Hull, gentleman, for improvements in preventing accidents on railways. Patent dated February 17; six months.

John Bottomly, of Bradford, in the county of York, manufacturer, for improvements in machinery for weaving. Patent dated February 22; six months.

Clemence Augustus Kurtz, of Wandsworth, in the county of Surrey, gentleman, for certain improvements in looms for weaving. Patent dated February 28; six months.

Obed Blake, of the Thames Plate Glass Company, Blackwall, in the county of Middlesex, manager, for certain improvements in the process or processes of manufacturing and finishing plates, sheets, or panes of glass. Patent dated February 28; six months.

Joseph Barker, of Esher-street, Kennington, artist, for an improved method of constructing umbrellas and parasols. Pated dated February 28; six months.

John Hick, of Bolton-le-moors, in the county of Lancaster, engineer, and William Hodson Gratrix, of Salford, in the same county, engineer, for certain improvements in steam engines, which improvements are more particularly applicable to marine engines, and also improvements in machinery or apparatus for propelling vessels. Patent dated February 28; six months.

Benjamin Biram, of Wentworth in the county of York, gentleman, for improvements in miners' lamps. Patent dated February 28; six months.

Robert Pollard, of Topsham, in the county of Devon, rope maker, for an improvement in rope making machinery. Patent dated February 28; six months.

Henry Crosley, of the firm of Henry Crosley, Son and Galsworthy, of Emerson-street, Surrey, engineers and coppersmiths, for certain improved modes or methods of, and apparatus for, heating and lighting, for drying substances, and for employing air in a warm and cold state for manufacturing purposes. Patent dated February 28; six months.

Perceval Moses Parsons, of Lewisham, in the county of Kent, civil engineer, for certain improvements in railways, railway engines, and carriages and certain of their appurtenances. Patent dated February 28; six months.

Amedee François Remond, of Birmingham, for improvements in machinery for folding envelopes, and the manufacture of envelopes. Patent dated February 28; six months.

William Brindley, of Twickenham, papier maché manufacturer, for improvements in the manufacture of waterproof paper. Patent dated February 28; six months.

Charles Jacob, of Nine-elms, Surrey, engineer, for improvements in the manufacture of earthenware tubes or pipes. Patent dated February 28; six months.

Dion de Boucicault, of the Quadrant, Regent-street, gentleman, for certain improvements in the mode or modes to be used for transmitting and distributing liquids and fluids for agricultural purposes, and for apparatus connected therewith. Patent dated February 28; six months.

Thomas Rowlandson, of Liverpool, chemist, for improvements in the treatment of certain mineral waters, to obtain products therefrom, and in obtaining certain metals from certain compounds containing those metals, and in obtaining other products, by the use of certain compounds containing metals. Patent dated February 28; six months.

Charles André Felix Rochaz, of New-court, St. Swithin's-lane, in the City of London, merchant, for improvements in the manufacture of oxide of zinc, and in the making of paints and cements where oxide of zinc is used. Patent dated February 28; six months.

Pierre Isidor David, of Paris, in the republic of France, for improvements in bleaching cotton. Patent dated February 28; six months.

Job Cutler, of Sparkbrook, near Birmingham, civil engineer, for certain improvements in the manufacture of metal pipes or tubes. Patent dated February 28; six months.

George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid parts, from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters. Patent dated February 28; six months.

Edward Westhead, of Manchester, manufacturer, for certain improvements in the manufacture of waddings. Patent dated March 3rd; six months.

Henry Constantine Jennings, of Abbey-street, Bermondsey, practical chemist, for improvements in the manufacture of vehicles for mixing pigments, and also in the manufacture of white lead. Patent dated March 5; six months.

Nathan Defries, of Grafton-street, Fitzroy-square. civil engineer, and George Brooks Pettit, of Brook-street, New-road, in the county of Middlesex, gas fitter, for improvements in applying gas to heat apparatus containing fluids, and in heating and ventilating buildings; also improvements in gas fittings, and in apparatus for controlling the passage of gas. Patent dated March 5; six months.

Samuel Banks, of West Leigh, in the county of Lancaster, miller, for for certain improvements in mills, for grinding wheat and other grain. Patent dated March 5; six months.

William Henry Green, of Basinghall-street, in the City of London, gentleman, for improvements in the preparation of fuel. Patent dated March 5; six months.

James Baird, of Gartsherrie, in the parish of Old Monkland, in the county of Lanark, in Scotland, iron-master, and Alexander Whitelaw, of the same place, manager, for improvements in the method or process of manufacturing iron. Patent dated March 7; six months.

James Williamson Brooke, of Camden Town, gentleman, for improvements in lamps. Patent dated March 14; six months.

Thomas Clarke, of Hackney, in the county of Middlesex, engineer, and Thomas Motley, of the city of Bristol, civil engineer, for certain improvements in obtaining and applying motive power; also improvements in railroads, and other roads, and in supporting pressure, resisting strain, and protecting against fire. Patent dated March 14; six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. Patent dated March 14; six months.

William Payne, of New Bond-street, watch and pedometer maker, for certain improvements in clocks and watches. Patent dated March 14; six months.

Alexander Swan, of Kircaldy, in the county of Fife, manufacturer, for improvements in heating apparatus, and in applying hot and warm air to manufacturing and other purposes where the same are required. Patent dated March 14; six months.

William Gratrix, of Salford, in the county of Lancaster, bleacher and dyer, for certain improvements in the method or process of drying and finishing woven and other fabrics, and in the machinery or apparatus for performing the same, part of which improvements is applicable to stretching woven fabrics. Patent dated March 14; six months.

Ignacio de Barros, of Lisbon, but now residing in Paris, gentleman, for improvements in machinery for making lasts for boots and shoes, butts or stocks for fire-arms, and other irregular forms. Patent dated Maach 14; six months.

Allen Bragg, of Queen's-row, Pentonville, bath-keeper, for improvements in propelling by atmospheric pressure. Patent dated March 14; six months.

Francis Hay Thomson, of Hope-street, Glasgow, doctor of medicine, for an improvement or improvements in smelting copper or other ores. Patent dated March 14; six months.

Pierre Augustin Chauffourier, of Regent's Quadrant, merchant, for certain improvements in the manufacture of watches. Patent dated March 14; six months.—(Communication.)

Peter Armond Lecomte de Fontaine Moreau, of South-street, Finsbury, London, for certain improvements in coating or covering metallic and non-metallic bodies. Patent dated March 14; six months.—(Communication.)

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND.

From 20th Day of December, 1848, to the 22nd Day of January 1849, Inclusive.

Duncan Mackenzie, of Goodman's Fields, in the county of Middlesex, manufacturer, for certain improvements in jacquard machinery, for figuring fabrics and tissues generally, and apparatus for transmission of designs to the said jacquard machinery, parts of which are applicable to playing musical instruments, composing printing types, and other like purposes. Sealed December 22; six months.

Stephen Taylor, of Ludgate-hill, in the City of London, gentleman, for certain improvements in the construction of fire-arms, and in cartridges for charging the same. Sealed December 26; six months.

George Fergusson Wilson, of Belmont, Vauxhall, in the county of Surrey, gentleman, and Charles Humphrey, of Manor-street, Old Kent Road, in the said county of Surrey, merchant, for improvements in the production of light by burning Oleic Acid in lamps, and in the construction of lamps, and manufacture or preparation of Oleic Acid for that purpose. Sealed December 28; six months.

Robert Angus Smith, of Manchester, for improvements in the application and preparation of coal tar. Sealed January 4; six months.

William Gilmour Wilson, of Port-Dundas, Glasgow, engineer, for improvements in the formation of moulds, and cores of moulds, for casting iron and other substances. Sealed January 4; six months.

Edward Schunck, of Rochdale, in the county of Lancaster, chemist, for improvements in the manufacture of malleable iron, and in treating other products obtained in the process. Sealed January 8; six months.

David Yoolow Stewart, of Montrose, in the kingdom of Scotland, iron founder, for improvements in the manufacture of moulds, and cores for casting iron, and other substances. Sealed January 10; six months.

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner Farmer, of Lyons' Wharf, Upper Fore-street, Lambeth, in the county of Surrey, for improvements in smelting copper. Sealed January 10; six months.

John Wright, of Camberwell, in the county of Surrey, engineer, for improvements in generating steam and evaporating fluids. Sealed January 10; six months.

Richard Roberts, of the Globe Works, Manchester, in the county of Lancaster, engineer, for certain improvements in and applicable to clocks and other timekeepers, in machinery, or apparatus for winding clocks and hoisting weights, and for effecting telegraphic communication between distant clocks and places, otherwise than by electro-magnetism. Sealed January 11; four months.

Edward Slaughter, of the Avonside Iron Works, Bristol, engineer, for improvements in marine steam engines. Sealed January 12; six months.

Israel Kinsman, late of New York, but now of Ludgate-hill, in the City of London, merchant, for improvements in the construction of rotary engines, to be worked by steam, air, or other elastic fluid. Sealed January 12; six months, (communication.)

Edward Smith, of Kentish Town, in the county of Middlesex, blind manufacturer, for improvements in window blinds, and in springs applicable to window blinds, doors, and other like purposes. Sealed January 16; six months.

Andrew Lamb, of Southampton, in the county of Hants, engineer, and William Alltoft Summers, of Millbrook, in the county of Southampton, engineer, for certain improvements in steam engines and steam boilers, and in certain apparatus connected therewith. Sealed January 16; six months.

William Edward Newton, of the Office for Patents, 66, Chancery Lane, in the county of Middlesex, civil engineer, for improvements in the construction of stoves, grates, furnaces, or fire-places, for various useful purposes. Sealed January 17; six months, (communication.)

Andrew Shanks, of Robert-street, Adelphi, in the county of Middlesex, engineer, for an improved mode of giving form to certain metals when in a fluid or molten state. Sealed January 17; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Sealed January 17; six months.

James Young, of Manchester, in the county of Lancaster, manufacturing chemist, for improvements in the preparation of certain materials, and in dyeing and printing. Sealed January 19; six months.

THE PATENT LAWS.

(TO THE EDITOR.)

Sir,—If a clinching argument were wanting to enforce a complete reform of our Patent Laws, I imagine it might be easily found in the numerous worthless schemes which are every day brought out under the imposing title of "Her Majesty's Letters Patent." To a practical man, there is something quite sickening in reading over the numerous abstracts of specifications which appear in your journal—and here I hope you will allow me to remark that they occupy a great deal of room in your pages—more, I think, than they deserve*—but there they are, monuments alike of the inefficiency of our laws, of the credulity of capitalists, and of the rapacity of patent agents. I need not go far for an example; and, as I see you occasionally give an opinion on the merits of patents, I will take one which I believe has not yet appeared in your "abstracts," but has been given at length in a contemporary journal. The title was an attractive one—"Improvements in oscillating engines;" and, being a great admirer of this form of engine, as made by Messrs. Penn, Messrs. Rennie, and others, I felt an anxiety to see what new arrangements an ingenious mind could devise, setting improvement aside, for the present, as a thing to be determined by experience. Judge then, sir, of my disgust at seeing an oscillating engine with the trunnions at the *bottom* of the cylinder, the trunnion also forming the shell of a four-way cock, and by its motion allowing of the entrance and exit of the steam at each end of the cylinder. Now, sir, this plan is as old as the oscillating engine itself, and I venture to say is the worst arrangement that could be devised. I have by me a sketch of an engine oscillating from the bottom, made at least fifteen years ago, and I am informed that Messrs. Easton and Amos have made some on that principle within the last few years. However, you may see models made in this way in several of the mathematical instrument makers' windows, with the patent four-way cock into the bargain. It will be hardly necessary to remind your readers that in ordinary (or "unimproved") oscillating engines, the trunnions being in the centre, the upper part of the cylinder is balanced by the lower part, and the preponderance, if any, is given to the lower end, so that the piston rod has only to overcome the friction of the trunnions, whereas in this "improved" engine the whole weight of the cylinder is thrown over on the rod, and I observe that the patentees especially mention its application to locomotive engines, where the evil would be greatly aggravated by the horizontal position of the cylinder, and its increased rapidity of motion. If, as the patentee tells us, it is of so great importance that the distance between the centre of oscillation and the centre of the crank shaft should be as great as possible, to diminish the oblique thrust of the piston rod, why did they not patent the arrangement with the cylinder turned upside down, hanging on the trunnions like a pendulum, so that the weight of the cylinder has a tendency to keep it in a vertical position? It is true that this form has been successfully made by Mr. Joyce, of Greenwich, and a Dr. Alban, of Germany, as described in your last volume, but that would not have mattered, as novelty does not seem to have been considered necessary; it seems to have been thought more important to patent something perfectly safe from infringement, and in that respect the patentees have certainly succeeded admirably. The four-way cock, instead of a slide, is an exploded scheme, which an engineer's apprentice, now-a-days, would be ashamed to put in his working model. It admits of no lap or lead, and could never be kept in order, with the cylinder swinging on it. Now, sir, my object in drawing attention to this puerile patent is not to run down any particular inventor or patent agent, but to show how money is thrown away under our present system of patent laws. It is possible that the drawings and specification in this case were drawn up by the inventor, and were put into the agent's hands to undergo the requisite formalities only, and that his opinion

* To the point, certainly, but we are endeavouring to catch up to the later patents.—Ed.Art.

was not asked as to the novelty or value of the contents. I suppose we may take it for granted that it would be expecting too much of a man of business that he should turn away a patentee from his office by telling him at once that his invention was not worth a rush, but I contend that our patent laws should not allow of his being placed in such a false position. Why are they not assimilated to those of the United States, where they will not admit an invention which is known to be old? They have their "examiners," who examine the patents submitted to them, and report on their eligibility. If this system had been in force in England, how many thousands of pounds might have been saved during the last fifty years! I believe that, if I were to name a sum which would appear preposterously large to your readers, it would not adequately represent the loss which has been incurred indirectly, because it is fair to assume that, if capitalists were persuaded that there was some check against patenting a worthless invention, they would be more ready to pay the trifling preliminary expenses necessary to obtain the examiner's opinion, and, consequently, the world would have had the advantage of many valuable secrets which have died with their possessors.

In conclusion, sir, allow me to add, that I am neither inventor, patent agent, or capitalist, but your very humble servant,

INVESTIGATOR.

SMITHFIELD MARKET *v.* ISLINGTON.

Where considerable personal interests are concerned on either side, and public considerations are merely their weapons of fence, it is never possible for the uninitiated (that is, 99 in a 100 of those who take no more than a newspaper interest in the matter) to become possessed of any true view of the question at issue. The extremes of argument on the subject above indicated, are a fine proof of this. On one hand, you might imagine that the filth of butchering among the dense population of the metropolis poisoned and destroyed the lives of a large proportion of the people; that drovers were the most atrocious of created beings, and took a delight in tormenting bullocks, so as to induce them to gore at least six per cent. of street passengers per annum, and to break china, glass, and crockeryware to an unlimited extent, and totally regardless of the expense. *Et cetera.*

On the other hand, you are required to believe that the vicinage of butchering is wonderfully conducive to human health; that if there were convenient promenades in Smithfield Market, instead of the very small squares called pens,* they would be frequented by families and fashion in preference to Hyde or Regent's Park; that drovers would not be a bit more urbane or humane out of the city, and that the change would cost a distinct increase of price on every pound of meat sold to the public.

This last is, after all, a consideration of some importance to housekeepers; for if butchers were obliged to bring their stock from a distance, instead of a central market, it is pretty evident that the additional expense of carriage would be thrown upon their customers. We mentioned in a former *Gazette*, that a gentleman, intimately acquainted with city dealings, calculated that this cost would amount, on an average, to a *penny per lb. on meat sold!*

With regard to unhealthiness, it may result from the accumulation of filth and garbage; but we generally see butchers and their wives (or, at any rate, one or other of them) lusty, hale looking persons; and, whether from their horse exercise or not, butchers' lads and men are about the freshest fellows upon town. Let any one who doubts this, ask their maid servants—sometimes, as we have heard whispered, their mistresses.

The debates in Guildhall on the subject this week are tolerably amusing,† and especially Alderman Lawrence's pitching into the press, with a great deal of courage and a good deal of truth. "Let the galled jade wince; our withers," &c., &c. We like to see a fair John Bull stand up for his bovine brethren being slaughtered in Smithfield, as religious martyrs were of old, when they were roasted whole for the edification of a Christian people.

The arguments against the continuance of the market in its present site seem to be principally drawn from a pamphlet published by Messrs. Ridgway (pp. 56), "showing the tendency of the present system to reduce the profits of the graziers, cause unnecessary cruelty to animals, poison the food of the poor, and give rise to the most disgraceful desecration of the sabbath."

But we do not think we should have touched on the business had it not connected with the antiquities of London, and thus coming quite legitimately within the scope of our literary illustrations. The dispute is of old standing, but in the first instance it was THE CHURCH and not THE CORPORATION which withstood the call for removal. In Strype's Stowe we find that one William Luda, sometime Dean of St. Martin's, stopped up a lane called *Vedast* (now, we believe, Foster) lane, which ran between *St. Martin's* and *St. Nicholas' Shambles* church.

"Whereupon, at an Inquisition made in Edward II. his reign, for purprestures and annoyances in the city, the King's justices sitting at the Tower, the jury presented this; and that it was to the damage of the King and the commonalty of the city. But Richard de Ellesfield, then Dean of St. Martin's, came in and shewed, that he held the said lane stopped up, by virtue of a license from King Edward I., and that by letters patents, which he produced."

Then Stinking-lane, alias Chick-lane, was *temp.* Henry VIII., kept more cleanly than before; but the objection to the market in the densely populous heart of the city was of more ancient date; for

"'In the 3rd of Richard II., motion was made that no butcher should kill any flesh within London; but at Knightsbridge, or such like distant place from the walls of the city; and this was but the renewing of a command strictly given by King Edward III., in the 35th of his reign, to the Mayor and Sheriffs, upon a great contagion in the city; which was thought to have been occasioned by the stink of slain beasts within or near the city. The King's letter will explain this matter more at large; and that confirmed, as it seems, in Parliament.

"'*Rex Maiori*, &c. *Quia par mactationem grossarum bestiarum*, &c., *i. e.*, 'Because by reason of killing of great beasts, &c., from whose putrified blood running down the streets, and the bowels cast into the Thames, the air of the city is very much corrupted and infected, whence abominable and most filthy stinks proceed, sicknesses and many other evils have happened to such as have abode in the said city, or have resorted to it; and greater dangers are feared to fall out for the time to come, unless remedy be presently made against it; WEE, willing to prevent such danger, and to provide as much as in Us lies, for the honesty of the said city, and the safety of our people, by the consent of Our Council in our present Parliament, have ordained, That all bulls, oxen, hogs and other gross creatures, to be slain for the sustentation of the said city, be lead as far as the town of Stretford, (*i. e.* Stratford le Bow,) on one part of London, and the town of Knightbrugg on the other; and there and not on this side, be slain. And that their bowels be there cleansed; and being so cleansed to be brought together with the flesh, to the said city to be sold. And if any butcher shall presume any thing rashly against this ordinance, let him incur forfeiture of the flesh of the creatures which he hath caused to be slain on this side the said towns, and the punishment of imprisonment for one year. This ordinance to be publicly proclaimed and held; and all butchers doing otherwise to be chastised and punished according to the form of the Ordinance aforesaid. Witness the King at Westminster, the 25th of February,' 1362."

"Afterwards, in giving, 'the Modern Estate of this large Ward,' (p.193,) Strype says, (p. 194.)

"'The part of Newgate Street, from Cheapside Conduit, a little above St. Martin's le Grand, unto the shambles, was called Blow-bladder Street, from the bladders there sold in former times.

"'The butchers inhabiting in this street have their slaughter houses in Butchers' Hall Lane, formerly called Stinking Lane, from the nastiness of the place; but now it is kept pretty clean, and here the company of butchers have their hall."

"In the fifth book, vol. ii., "containing an account of the government, and governours of the said city; its corporations and trades; its laws, orders, and customs, and militia;' chap. xii. page 212, it is said—'Upon occasion of the plague in Queen Elizabeth's reign, continuing in the city for a long time, (whether it were that in the Year 1563, or some plague afterwards happening, I cannot tell,) an ingenious Italian gentleman and physician, as it seems, assigned one great cause of it to be, the killing cattel within the city. Blood and garbage lying so long in the shops, and in some other corners before it was removed, gave a most unsavoury smell. And this chiefly in Eastcheape and St. Nicholas Flesh Shambles, places of great thoroughfare. And, carried away by night, thorow the streets into the river, spread as it passed, a very offensive scent, leaving it behind. Therefore, he propounded, that the Queen should build in some convenient place in the suburbs of this

* We have all heard the story of the Scotchman, who had not been long caught, and wending his way to his lodgings on a dark night, after too copious libations of whisky toddy with a friend near Smithfield, got accidentally into this area of pens, and kept wandering about in the maze till morning, every now and then exclaiming, as he felt his way, "Lord sauf me, I hae heard of the number of squares there were in Lunnun, but wha should hae thought there were sae very many and sae sma!"

† They have ended in the defeat of Mr. Norris's motion for the removal of the market y a large majority.—ED. L. G.

and other cities, slaughter-houses, where the butchers should kill their beasts; and the Queen to be allowed for every beast killed in her slaughter-house. Especially there being an Act of Parliament in the reign of Henry VII. for this purpose.'"

So that suburban Slaughter Houses or Abattoirs are no novelties; and Knightsbridge and Stratford-le-Bow only preceded Islington.—*Literary Gazette.*

ON THE ARRANGEMENT OF THE WEIGHTS IN THE HOLD OF THE SHIPS OF THE LINE, AND THE GENERAL VENTILATION OF THE LOWER BODY.

At present the coals are stowed well forward, and are a considerable mass —say 90 tons in most cases: this is a variable quantity. The shot, of much greater weight, is contained in three lockers, near the main-mast These masses of dead-weight, or inertia, it is considered, should be divided or separated into smaller parts, and removed from the lowest part of the body, and the ballast extended over the body, particularly longitudinally.

It is proposed to stow the tanks and the provisions in the after-hold on platforms, reaching from the after-bulkhead of the fore-magazine to the after-bulkhead of the after-hold. The platform in the fore and main holds to be placed a small distance above the keelson, that all the ballast (when well extended) may be stowed there, and sufficient space for cleaningand removing, and a free circulation of air; the platform in the after-hold may be somewhat lower. The beams of the platform are nine inches; therefore four inches of each end of the tank will rest on the beam. It will not require to be planked, only some *ways* to slide the tanks on; the platform of the after-hold will require open planking, to permit ventilation. The quantity of water will be little less than at present. There will be some small loss of stowage in the after-hold; this will be met by the aftermost shot locker in that part being thrown into the stowage. It is proposed to arrange the stowage of the fore and main holds thus—the foremost shot-locker to be removed, and there to stow the aftermost tanks, four on each side, two tiers, with a butt or puncheon over; there will be twelve longers in a ship of 120 guns.

Next is the disposal of the shot and coals. The space from the outside tank is divided from the hold by a bulkhead of great strength. It runs from the after end of the main hold to the bulkhead of the fore magazine; 64 feet of this BUNKER, or long wing (under the orlop deck) is divided into five compartments on each side of the ship. The after end of this bunker is allotted to shot, in length 10 feet; the next 20 feet for coals (centre of the ship); the next 8 feet to shot; the next 16 feet to coals; and the next 10 feet to shot. This will reach nearly the fore-hatchway.

By this arrangement a more ready supply of shot for action will be obtained by *scuttles* to each compartment being cut on the orlop deck; and by a scuttle on the lower deck, near the gangway port, the coals will readily pass down into the bunker, and the supply for the cooks can be conveyed in boxes, of one-and-a-half, or two bushels, from the bunkers. The shot bunkers will not be full; therefore the trimming of the ship can most readily take place by moving weight from one bunker to another.

The effect of the removal of the masses from the centre in all ships, arranged on this principle, will be that they will be found more easy, more particularly the ships with sharp bottoms, and having a great tendency to roll.

By the separation and extenson of these masses, the sailing qualities will be found to be improved; expense of repairs and refitment less, and by the free circulation that will take place by means of the platforms, the decay much reduced; the health of the crews of Her Majesty's ships much improved; and the service thereby benefitted; the country will find that each year the expense of the navy will be less, so that it is possible the idea of Mr. Hume, that—"we are not required to construct large ships in any number for the next twenty years" may be realized. When a good height for the platform is obtained in a deep ship, the ballast can be increased, diminished, or restored without the breaking up of the holds. A suction pump, such as that fitted to the Frolic, brig, would tend to assist ventilation in an eminent degree. By working the pump a few hours each day, the foul air is withdrawn, and a healthy dryness created, both beneficial to the crew and the ship. This plan is not confined to ships of war in commission.—W. H.—*Nautical Standard.*

THE SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Thursday, February 27, 1849.

JOSHUA FIELD, ESQ., President in the Chair.

The paper read was "On Fire-proof Buildings," by Mr. James Braidwood, Assoc. Inst. C.E. After alluding to the paper by Mr. Fairbairn, on the construction of buildings of this description, which was read during the session of 1847, the author proceeded to analyse the evidence as to the capability exhibited by cast and wrought-iron beams, for sustaining weights, where they were exposed to any extreme changes of temperature. He then demonstrated, by a collection of specimens of metal from buildings that had been destroyed by fire, that occasionally the temperature in the conflagration of large buildings rose almost to the melting point of cast-iron, and that, even in a small fire, beams and columns of cast-iron would be so affected by the heat and the jets of water upon them, that they would probably be destroyed, and sometimes cause a fearful loss of life; as in many of the so-called fireproof warehouses of the city, a number of persons employed on the premises slept in the upper floors, and if the lower beams gave way, the whole would be dragged down suddenly; whereas timber beams resisted fire some time, and allowed time for the inmates to escape. The firemen also, were liable to more danger from the same circumstance; as the only chance of extinguishing fires was to send them into the buildings with the branches and water-hose; but where there was such evident danger, the men were forbidden to enter, and limited their efforts to restraining the spreading of the fire.

Another point which the author considered had not been sufficiently insisted on, was the derangement of the brickwork by the expansion of the iron beams at high temperature, and its sudden contraction on the application of cold water; and, also, from the mortar becoming completely pulverised by the excessive heat—instances of which have been known to occur.

The following were the principles on which Mr. Fairbairn proposed to construct Fire-proof Buildings:—

1. The whole of the building to be composed of incombustible materials, such as iron, stone, or brick.
2. That every opening or crevice communicating with the external atmosphere be kept closed.
3. An isolated stone or iron staircase to be attached to every story, and to be furnished with a line of water-pipes communicating with the mains in the street.
4. The different warehouses to be divided by strong partition walls, and no more openings to be made than are absolutely necessary.
5. That the iron columns, beams, and brick arches be of a strength sufficient not only to support a continuous dead pressure, but also to resist the force of impact to which they are subject.

Lastly: That in order to prevent the columns from being melted, a current of cold air be introduced into the hollow of the columns from an arched tunnel under the floors.

Mr. Braidwood argued that there could be no doubt, if the second principle could be enforced, a fire would go out of itself; but it was very doubtful if the object was not defeated by carelessnes in leaving a door or window open just at the time when a fire occured.

The fifth principle showed that Mr. Fairbairn had not laid sufficient

stress on the loss of strength to the iron consequent on an increase of temperature; and the last principle, it was thought, would not be likely to answer the purpose, as a specimen of 1½ inch cast-iron pipe, on being heated in the centre, with both ends open, and a current of air passing through it, gave way on one end being held in a vice, and the other pulled with slight force by the hand, after an exposure of only four minutes in the fire.

For these reasons and others, the author submitted that large buildings containing considerable quantities of combustible goods, and constructed on the usual system, were not practically fire-proof; and that the only construction which would render such buildings safe, would be groined brick arches, supported by pillars of the same materials laid in cement. The author was also of opinion, that the loss by fire would be much reduced if warehouses were built of a more moderate size, and completely separated from each other by strong party walls, instead of being constructed in immense ranges, into which, when fire had once penetrated, it set at defiance all efforts to extinguish it.

In the discussion which ensued, the accuracy of Mr. Braidwood's general statements was fully allowed; and it was generally acknowledged, that the principles upon which many buildings, particularly dwellings, were constructed, were very erroneous. It was argued, that even with the ordinary materials, if attention was paid to filling-in the partitions and ceilings, as practised in France, and mentioned in Professor Hosking's books on the construction of buildings; using slate or stone for the stairs, as from its present cheapness might be done, taking care to support the steps properly, a fire would spread very slowly, and would allow ample time for the escape of the inhabitants.

Beardmore's, Fox and Barrett's, and Nasmyth's new systems of flooring, were all alluded to; as was Mr. P. Fairbairn's fire-proof dwelling-house at Leeds, of which a drawing and description was promised for the next meeting.

Chubb's, Marr's, and other fire-proof safes were advantageously mentioned, and were shown to have effectually preserved the deeds within them in the most intense conflagrations.

Tuesday, March 6, 1849.

JOSHUA FIELD, Esq., President, in the Chair.

The discussion on Mr. Braidwood's paper "On Fireproof Buildings," was renewed, and extended to such a length as to preclude the reading of any paper.

It was urged, that the intention of Mr. Fairbairn's paper, and that of Mr. Braidwood, had been somewhat misunderstood; the former had for object the description of defects in the construction of fireproof buildings for supporting heavy weights of machinery, &c.; and the latter, leaving untouched the question of construction, viewed the effects of fire upon metal beams in fireproof buildings. These were widely different questions.

The consideration of what was the actual loss of strength of cast-iron, under different degrees of elevation of temperature, was of vital importance. It appeared, from the evidence of Fairbairn's and Hodgkinson's experiments, that there was very little difference of strength between iron, at a temperature below the freezing point, and when raised to nearly six hundred degrees Fahrenheit. When however, cast-iron columns and beams were practically subjected to the draught, or current of air, of a tremendous fire in an extensive warehouse filled with combustible goods, and at the same time receiving large quantities of water from the engines, they must fail, either by melting, or crushing.

It appeared, that all the means of arresting fires generally failed, when there was a large area on fire, and that the only effective means of prevention would be, to have smaller and detached warehouses, or separating walls within the larger storehouses; but, inasmuch, as this was a very expensive mode of building, and the land where warehouses were required was very costly, it became entirely a mercantile question, whether it was better to lay out a large capital in making a building perfectly fireproof, and providing such means as were in use in a mill at Oldham, for deluging, the rooms, on an alarm of fire, or pay an insurance and incur a certain amount of risk.

That the risk of fire in dwelling-houses was not very great, appeared to be admitted, by the small rate of insurance demanded—generally from eighteenpence to two shillings per cent., upon which the government charged three shillings additional for stamps—certainly the lion's share—without bearing any of the risk.

It was shown, that the system of constructing mills containing machinery with iron beams and brick arches, was as much for the purpose of avoiding the tremulous movement imparted by wooden beams and floors, as for avoiding the risk of fire; for such were the precautions and care in the mills, that very few were destroyed by fire. It was suggested, that bricks might be made expressly of the proper form to surround the slight iron columns used in buildings, and thus completely protect them from any injury from fire.

Phillip's system of extinguishing fires, by means of carbonic acid gas and steam, was mentioned; and it appeared, that it was excellent for isolated houses in the country; for use in the hold of a ship, or inside any room; to arrest a fire at the commencement, without injury to the furniture, &c.; but that it could not be rendered so useful as water, in preventing the extension of fires to adjoining buildings.

The interesting discussion was interrupted by the monthly ballot, when the following candidates were elected:—G. Meredith, A. H. Bampton, W. P. Struve, T. C. Watson, W. Scamp, H. Maudslay, J. W. Leather, and I. Coode, as Members; Lieut. Col. J. A. Lloyd, R.E., Captain Sir E. Belcher, R.N., C. B. Lane, H. G. Robinson, T. Gibbins, G. A. Biddell, I. N. Warren, C. P. Roney, C. L. A. De Bergue, E. B. Wilson, H. Robinson, S. D. Martin, W. T. Doyne, W. Swann, H. Vignoles, W. B. Lambert, and R. A. Stickney, as Associates.

Tuesday, March 13th, 1849.

JOSHUA FIELD, Esq., President, in the Chair.

The paper read was "A description of the Camden Station of the London and North Western Railway," by Mr. R. B. Dockray, M. Inst. C. E.

In the first design of the railway, in 1833, this station was intended for the sole terminus of the line, and after much discussion, thirty acres of ground were purchased, although that quantity was considered preposterously large by some of the directors. A very short time demonstrated the necessity for the establishment of the Euston Station solely for passengers; and fourteen acres were there secured, and ultimately covered with buildings. The whole station at Camden was then devoted to goods and cattle; and although in the original design great care was taken to anticipate the wants of the traffic, yet such has been the rapid development of the railway system, that in the space of ten years it has proved necessary to sweep away almost every vestige of the original constructions, and entirely to remodel the station. These changes have partly produced by the increase in the goods' traffic, which was first undertaken by the great carriers, who built large warehouses on the Company's land. The whole system has, however, been reformed, and the Company do all that business, and are responsible to the public for the due performance.

As the increase of the traffic progressed, the trains in the sidings frequently became of such length as to cause danger to the passenger trains; it therefore became necessary to alter the whole disposition; which has been so done, as now to give a length of double line of two thousand five hundred feet for the goods' waggons only, entirely clear of the main line.

Another reason for the alterations was, the demand by the public for a more rapid rate of travelling; this demanded heavier and larger engines, and necessitated wider buildings and larger turn-tables; in fact, everything required to be remodelled;—and the results of all these changes were shown in detail in the paper and the illustrating drawings.

The circular engine-house, one hundred and sixty feet diameter, to contain twenty-four engines and tender, with a central turn-table, forty-one

feet in diameter, and an iron roof, was excellently described; as were also the other engine-houses, stores, warehouses, sheds, &c., with their appurtenances; and among the external works, the new wrought-iron bridge, at Chalk Farm, on Mr. R. Stephenson's box-girder principle, and the wooden lattice bridge, over the Regent's Canal.

The supply of water for the locomotive engines was then treated of at some length, and exhibited some curious anomalies. The only water that could originally be used, was taken from wells at Tring and at Watford; an attempt was, however, made to obtain a supply at Camden Station, first from the Regent's Canal, and then by sinking a well down one hundred and forty-five feet into the chalk, or to a total depth of three hundred feet, below Trinity high-water mark. The water from the sand stratum was excluded, and although only that from the chalk was pumped up, which ought to have possessed the same qualities as the water at Tring and Watford, derived also from the chalk, yet it was found to cause the locomotive to "prime," or flush water through the cylinders, with the steam, to such an extent as to seriously impede the progress of the trains. This was shown, by analysis, to arise from the excess of carbonate of soda contained in this well water, which there was an entire absence of in the waters of the wells at Tring and at Watford.

The well therefore, became useless for the engines, but the water was so excellent for household and other purposes, that it has been employed for the general uses of the station, and for the hotels and houses belonging to the Company.

Some idea of the extent of the Station was given by the statement, that the length of single line railway, exclusive of the main lines, exceeded twelve miles. There were one hundred and twelve sets of points, one hundred and ninety-six turn-plates, and one hundred and ten cranes, varying in power from one ton and a half to twenty tons. The area of goods' sheds was upwards of one hundred and thirty-five thousand superficial feet, and that of the platforms was thirty thousand feet.

The annual consumption of gas exceeded six millions of cubic feet.

The discussion that ensued, turned chiefly on the causes of the excess of alkalinity in the water at that spot, and it was suggested, that it might be owing to the rapid filtration of surface water through a crevice in the chalk upon which that well had been sunk; as a cure for the "priming," it was suggested to try a minute quantity of sulphuric acid to neutralise the alkali. There appeared, however, to be a question whether the water from the green sand was really completely excluded.

The subject was announced to be resumed at the next meeting, of Tuesday, March 20th, when the paper read would be "On Electric Telegraphs." By Mr. E. Highton, Assoc. Inst. C. E.

ROYAL INSTITUTION.

Feb. 16.—Mr. Grove, "On Voltaic Ignition," commenced by reminding his hearers that nine years had elapsed since he had in that theatre brought to their notice a voltaic combination, by which effects, previously attainable only by costly apparatus, occupying a large space and unmanageable for practical purposes, could be produced by a small and comparatively inexpensive apparatus. Since that time many efforts had been made to apply the brilliant flame produced by the terminals of the voltaic battery to practical purposes of illumination, and although this evening's communication would principally relate to some points of scientific interest in the phenomena of voltaic ignition, and indeed, he had intended it to apply exclusively to such, still as he found that many members of the institution expected him to refer to the problem of its practical application, he would, if the time permitted, state briefly his impressions as to the probability of success of such application. If each individual there present was asked to define, according to his separate notion, what heat was, each would probably give a different definition. The phenomena of sensation produced by secondary causes on the application of heat gave rise to various impressions, which presented great difficulties in the way of attaining anything like an abstract mental idea of heat. As far, however, as such could be obtained, it resolved itself into a conception of expansive or repulsive force taking place between the molecules of bodies on their temperature being increased, and causing such bodies to occupy more space with reference to other bodies than they previously did. He noticed the exception in the case of certain bodies when approaching the crystallizing, or freezing points, and the assigned cause of it, and he also noticed the experiments by which evidence had been afforded of a repulsive action of heat at sensible distances, by Fresnel Saigey and Baden Powell. Mr. Grove next considered the mode in which heat might be produced, and having, in his last communication at that table, viewed heat in its mechanical relations, he proposed this evening to regard it when produced by chemical actions, which are themselves, perhaps, when rigidly investigated, mechanical. All chemical combination is attended by a development of heat, though this may sometimes be masked or overcome by accompanying physical dilatation. In the heat developed in chemical combination, each molecule of the one combining body acts upon the contiguous molecule of the other, and so the heat takes place throughout the whole mass with no definite direction. By the great discovery of Volta, chemical affinity can be transferred, and a chemical combination taking place at one point of space, can produce a chemical decomposition at another point, a chain of material particles of indefinite extent being interposed. Thus he showed a decomposition produced, and the substance iodine evolved from a compound in which it previously existed, although long wires and his own body were interposed between the substances chemically combining and that undergoing decomposition. He explained the definite or measurable chemical character of this force. That which takes place with chemical action can also be exhibited with the heat produced by chemical action, which may be transferred from the *locale* of chemical action and made to appear in distinct points of space. Several experiments illustrative of this were shown, the ignition taking place at the points where the voltaic circuit was most contracted. This calorific effect differs according to the molecular structure of the voltaically ignited substance, and the nature of the surrounding medium; and in this, as in all other natural phenomena, not only the phenomenon under consideration, but all its attending circumstances, must be taken into account rightly to appreciate it. Thus, an ignition which is manifested to the senses in certain media, such as atmospheric air, is imperceptible without a more refined examination when in hydrogen gas and in many of its compounds. This is traceable to a cooling effect of the latter gases not dependent upon their specific levity, their specific heat, or their conducting power, but apparently upon a molecular constitution, which enables them more rapidly to convey away the heat generated. Combustion is, probably, a similar effect, taking place between the contiguous molecules of substances chemically uniting, to that which takes place in voltaic ignition by the transferred power. Common flame bears the same relation to voltaic ignition which ordinary chemical action does to electrolysis, and the same effect of the surrounding media is observable in cases of ordinary combustion as those of voltaic ignition. Thus, as was shown, a jet of carburetted hydrogen burned in air gives a more diffuse and brilliant flame than when the converse takes place, and oxygen is burned in an atmosphere of carburetted hydrogen. From the cooling effect of hydrogenous gases, atmospheric air will not burn in these gases when issuing through a jet of the same size as that through which the oxygen will burn; but if a gas or vapour analogous in its chemical character to hydrogen be used, but which has not the same cooling effect, atmospheric air and even the human breath will burn. Thus, Mr. Grove, by breathing through a tube into a vessel containing the vapour of phosphorus, showed his own breath burning with flame, realizing the fabled power of breathing flames of fire. The terminals of a voltaic battery attract each other, and if mobile, will approach: this was shown by making the terminals consist of a delicate conducting substance (gold leaf,) which approach and coalesce. If then we conceive the terminals to consist of a very mobile conductor, such as a liquified or fused body, portions of this will pass from one terminal to another, and the portions being small, or, in other words, the circuit contracted, the molecules passing over will be highly ignited; this is the voltaic arc, one of the most interesting physical phenomena

with which we are acquainted. This arc is also similarly affected by the surrounding medium: thus, he showed that between copper terminals a brilliant and continuous arc could be obtained in nitrogen gas while in hydrogen gas all that could be obtained was a slight spark at the moment of disruption of continuity, although both these gases are alike in their inability to support combustion. Mr. Grove then passed to some theoretical considerations respecting voltaic ignition; it appeared to him that an action transverse to the line of direction of the voltaic current took place. He had discovered that when a platina wire is fused by the voltaic current, but so placed as to retain its position, the fused wire contracts in length and ultimately snaps. When lead wire is similarly acted on, it distends into nodules which press upon each other, as a gullet tied with bands of string would when distended by air, and the nodules press upon each other, forming dividing facets. It is well known that with Franklinic electricity when a powerful discharge is passed through a narrow wire, the wire is shortened, and when the discharge is sufficient to explode the wire, the direction of the explosive force is indicated by lines transverse to the direction of the discharge. He described a most curious phenomenon, which he had observed in conjunction with Mr. Gassiot, when experimenting with a powerful battery belonging to the latter gentleman (500 cells of the nitric acid combination.) With this battery the voltaic discharge can be taken from the surface of distilled water, and when the anode is immersed in water, and the cathode withdrawn from the surface, a lambent pyramid is projected from the water the intense heat of which fuses the platinum wire forming the cathode, and a liquid globule of platinum, intensely incandescent, is suspended at the apex of this pyramid, apparently in mid air, and will not drop, being supported by a repulsive action, as a cork-ball is on a *jet d'eau*. This phenomenon he hoped to have an opportunity of further examining. Mr. Grove then passed to the consideration of certain practical applications of voltaic ignition and the voltaic arc, such as Eudiometry, lighting mines, street-lighting, and light-houses. He had made some experiments six years ago on the subject, and then on one occasion delivered a lecture at the London Institution, the theatre being illuminated by the voltaic arc. In preparing the present lecture, he had made a rough calculation as to its expense, and the matter appeared to him (though attended with many practical difficulties) to be hopeful and promising. By interposing a voltameter in the circuit while the arc was produced, the consumption in the battery could be calculated; for every chemical equivalent of hydrogen evolved in the voltameter, an equivalent of zinc, of sulphuric acid, and one-third of an equivalent of nitric acid, would be consumed in each cell of the battery. Supplying these data for calculation, and making proper allowance for the amount of water contained in the commercial acids, &c., the theoretical expense of a battery such as he was exhibiting (fifty cells of the nitric acid combination, each platinum plate two inches by four) would be about two shillings an hour. He had tested by the photometric method of equality of shadows the intensity of the light as compared with a common wax candle, and found that after the battery had been an hour at work the voltaic light was to the candle as 1444 to 1. He did not take this comparison of intensities as an absolutely fair practical comparison, nor did he give the above as a practical calculation, but he thought it would be safe if twice that expense, or four shillings per hour, were assumed; the actual expense of charging the battery for a given time of action bore this out. He showed the inferiority of central as compared with separate lights for street illumination, but for light-houses, particularly for an intermittent light at regular intervals, or for signal lights, the application appeared to him to be reasonably approximate; and for more general purposes far from hopeless, the practical difficulties, though undoubtedly not small, being, in his opinion, by no means insurmontable,

March 9th.—Mr. B. C. Brodie, "On the Chemical Relations of Wax and Fat," developed the not only strong chemical resemblance, but the perfect analogy that exists between waxes, fats, and alcohols; which led him, moreover, to pronounce alcohol to be a dilute fat—the liquid of a very fluid fat,—and to believe that if it ever should be solidified it would become fat. This opinion is based upon the chemical constitution of all these substances and their conversion into acids; and experimental investigations had led Mr. Brodie to place all fats and waxes in the alcoholic series, commencing with wood spirit, which yields formic acid, $C_2\ H_2\ O_4$, and ending with melissic acid, an acid of wax, $C_{60}\ H_{60}\ O_4$. A table included eighteen acids, the products of alcohol, vegetable and animal fats and wax, and exhibited a singular and attractive numerical progression; there were many gaps, which, however, Mr. Brodie thinks will be soon filled up. He thinks, too, that before many years wax will be made out of sugar. Experiment has already proved that the bee can so make it. To sugar the chemical origin of fat in the animal system is attributed by many, although others think that fat is taken up as food, and passed into the system unaltered. From Mr. Brodie's exposition of the chemical relations of these bodies, we hold to the former view, and incline in all respects to his opinion regarding the alcoholic series, which presents a most interesting field for chemical research.

BRUSSELS ACADEMY OF SCIENCES.

OF THE PASSAGE OF HYDROGEN GAS THROUGH SOLID BODIES. BY M. LOUZET.

If a horizontal current of hydrogen gas, emanating from a capillary orifice, be directed towards a sheet of paper, held vertically at the distance of a few millimeters from the orifice, in such a manner the current may be perpendicular to the paper, the paper is traversed by the gas. But the gas does not, so to say, sift itself through the paper, as might be expected; it resumes its form of a column, and may be inflamed behind the paper with just as great readiness as if the paper were not interposed between the current of gas and the ignited body. Again, if a ball of spongy platina be placed behind the paper, and in the direction of the current of hydrogen, the metal becomes red hot; if the sheet of paper be an inch or so from the orifice, provided that the platina be placed close to the paper—or but a short distance from it. It is well to remark that the pressure under which this phenomena is effected does not exceed that of four or five inches of water.

"To my great surprise," adds M. Louzet, "I found that the hydrogen gas traversed in the same way gold and silver leaf. Thus, if a ball of spongy platina be enveloped in several folds of gold or silver leaf, and a current of hydrogen gas be directed against it, it soon becomes red hot, and the gold or silver will adhere to its surface. A ball of spongy platina placed behind a leaf of tin foil, against which a current of hydrogen gas was directed, became highly heated, but without being red hot. But as tin foil is pierced with a multitude of fine holes, which may be perceived by placing a leaf between the eye and the light, the phenomena is not very remarkable. If, however, the tin foil be doubled, the platina still becomes strongly heated.

"Hydrogen gas passes in the same manner through a fine membrane of gutta-percha, such as is obtained by evaporating a thin layer of a solution of gutta-percha in chloroform. But hydrogen gas will not traverse small pellicles of glass, however thin they may be obtained.

"These experiments may be very correctly performed with Dobereiner's apparatus for the production of instantaneous light, an apparatus well known in England."

ANALYSIS OF BOOKS.

The Sea-Wall Question analysed and practically resolved. By W. H. Smith, C.E. London: Longman & Co., 1849.

Mr. Smith has chosen a tough subject to tackle, and he may be well excused even if he should not entirely succeed in bringing round to his opinions that large class of experimenters and mathematicians, who have all proved the value of their own plans by the prettiest models and the most undeniable mathematics. One would imagine that the experience acquired in building and maintaining Plymouth Breakwater, and other large works of a similar kind on the continent, would at least have determined the *principles* on which they should be constructed; but so far from this being the case, (to quote Mr. Smith's pamphlet), "on the one side we find such

men as Major-General Sir J. Burgoyne, Major-General Pasley, Colonel Jones, Mr. Reibel, Mr. Rendel, Mr. Stephenson, Mr. Brunel, amongst engineers; Sir Henry de la Beche, Professors Barlow and Airey, with the majority of the Harbour Commissioners, and various others; on the other, names equally powerful, Mr. Cubitt, Sir John Rennie, Mr. George Rennie, Mr. James Walker, with Major-General Sir Howard Douglas, and Sir William Symonds, of the Harbour Commissioners, each party in array against the other, with views of an entirely opposite character; the former section of the commissioners affirming that in every instance the breakwaters hitherto constructed have failed, whilst Sir Howard Douglas and his party are equally strong in their views and anticipations of failure for the vertical wall, which the majority of the commissioners have determined upon, and are now commencing at Dover Bay." When such eminent authorities disagree, we do not feel called upon to express any very decided opinion ourselves on the subject. Mr. Smith proposes to combine all the advantages of floating, with those of fixed, breakwaters, with much greater economy in the construction.

"A wave will even lift lead, a considerable weight of which was carried away in the construction of the Eddystone Light-house; and single blocks of the heaviest description of stone, of from forty to fifty tons, have been moved by a storm. On the other hand, the lightest bodies, by yielding sufficiently to nature, act as a breakwater. The trumpet-mouthed weed of the Cape of Good Hope, *laminaria buxinalis*, which grows to a height of twenty or thirty feet, breaks up the waves in a storm, and allows large ships to take secure shelter behind it."

Mr. Smith has aimed, in the construction of his breakwater, at copying nature, and his arrangement is as follows:—A strong vertical frame-work of timber is moored by means of screw-piles in the desired situation, and is connected to the screw-piles by means of a link, which allows of a certain amount of motion; inflexible stay-rods with heavy counterbalance weights at their ends, stretch out seawards, say at an angle of 45° when the framing is vertical; and horizontal tie-rods connect these weights to mooring blocks or screw-piles still further seaward. The effect is that when this frame-work is struck by a wave, it cants over, working on the link at bottom as a pivot, and thereby raises the balance weight. The strain required to lift the weights is slight at first, but increases rapidly as the two tie-rods approach one straight line; on the wave receding, the balance weights cause the frame-work to re-assume its original vertical position. A gangway may be mounted on the top of a separate and independent system of timbers, which being placed at a considerable distance apart, will be but slightly affected by the motion, the intervening spaces being occupied by the arrangement described above.

This then is Mr. Smith's proposition, and though we foresee that many difficulties might arise from the formation of shoals around the erection, yet the principle being sound, we think it deserves at least a fair trial. One of the greatest of its advantages would be its economy, which would admit of its introduction in situations which would never pay for the enormous first cost and repairs of a Plymouth breakwater. We know many small ports on the English coast, the property around which would be doubled in value, if this invention be but proved effectual. Mr. Smith particularly mentions the cases of the Irish and Scotch fishing coasts; on the latter, the loss for want of a harbour during the last year, is estimated at upwards of ten thousand pounds.

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(Continued from page 71).

JOINER.

All flooring-boards and battens, all outside linings to sash-frames, and all deals and battens used in the basement and ground story doors and fittings, to be yellow stuff, and to be listed clear of sap. All work connected with skylights, all deal skylights and sashes, and all doors and fittings opening on to flats in upper stories, to be also yellow deal, and to be listed similarly. All glued joints, in all work, inside and out, in deal, batten stuff, wainscot, or oak, to be feathertongued. All grounds, and all other linings or works which are connected with plastering, to be extra grooved. To fix to all door-ways six stout blockings for locks and hinges, beyond the customary backings, which blockings are to be wrought fair, and are to be dovetailed to the grounds. All rebates in jamb linings, and all edges of doors to be slightly splayed, to allow them to shut close, and yet to open easily.

Sashes and Frames.

All pulley-styles to be wainscot, and 1¼ in. thick; all beads finished 1½ inch wide; all outside linings 1¼-inch thick; all inside linings 1-inch thick; all deal-cased frames to have double sunk oak sills; all sashes double hung, with patent plaited flax lines and iron weights; and brass axle pulleys, lead weights, and catgut lines, to part which will be so described. Wainscot beads, fixed with brass screws and sockets.

The wainscot-cased frames to be deal, but with wainscot edges, pulley-styles, heads, and beads; all to have catgut lines and lead weights.

Generally, allow for the proper casing and preserving of all works belonging to water-closets, sinks, cisterns, and urinals, and deliver them up to occupiers in a clean and perfect condition. Generally, all works in wainscot to be rebated and tongued together, and fixed with screws; and all screw-heads to be concealed by wainscot wafers. Generally, execute all joiner's work, and provide and fix all ironmongery and brass work shown in the drawings and herein described, and necessary to complete all other works, and to render perfect the intended designs.

Flooring.

Basement Story.—To lay all parts of the basement story, not paved, with 1¼-inch yellow deal straight-joint floor, heading joints splayed, and make fair joints to paving. All floors of water-closets to be six inches above adjoining paving or floors; and fix to outer edges of the same 1¼-inch rounded nosing 2½-inches wide, and inch oak riser scribed to paving 5-inches wide.

Ground Story.—To lay every part of the ground story, not paved, with 1½-inch yellow battens, laid straight-joint, edge-nailed, and heading joints ploughed and tongued. Lay 1¼-inch wrought batten floor to cistern rooms over water-closets and urinals.

Mezzanine Story.—To lay every part of this story, not paved, with 1¼-inch yellow batten floor, laid straight-joint, edged-nailed, and splayed headings.

First Story.—To lay every part of this story, not paved, with 1½-inch yellow battens, laid straight-joint, edges nailed, and heading joints ploughed and tongued. The battens for this floor to be the best picked and selected battens.

Second Story.—To be laid with similar batten flooring to that described for the mezzanine floor.

N.B.— The flooring in tower is described in the carpentry. All floorings to be cleaned off, preserved, and delivered up clean at the finish of the works, being replaned in any cases that may require it.

Doors and Fittings.

Second Story: Lloyd's Rooms.—The four doorways in partitions to have 2-inch deal four-panel moulded both sides doors, 3-feet by 7; 1¼-inch single rebated jambs, rounded one edge, staff beaded the other, with 1¼-inch ground, and moulding 3½-inches girt on one side, 4½-inch butt hinges and 7-inch mortice locks.

A. { Royal-Exchange Assurance Rooms.—To fix to doorway to large flat in angle, 2-inch two panel moulded and bead flush sash door, 7 ft. by 3; proper doorcase 7 in. by 3½, with oak sill the same size; 4-inch butt hinges, mortice dead lock, narrow grounds, and single architrave 4 inches girt. Fix outside fittings, to keep out wet, of the prime cost value of 12s. To fix to doorway from kitchen to flat similar frame, but of extra height to allow fan sash 3ft. high, and transom to match; and fix outside similar fittings. The doors, 7 ft. by 4 ft. 3½, to be 2-inch one-panel bead

flush and square folding sash doors, diminished styles, 4-inch butt hinges, tw 10-inch bolts, and 7-in. rim lock; narrow grounds, and architrave inside. To fix to the three doorways of landing and luncheon-room, 2-inch four panel moulded both sides doors; 3 ft. by 6 ft. 8; $1\frac{1}{4}$-inch double rebated jamb linings, $1\frac{1}{4}$-inch grounds, $4\frac{1}{2}$ inches wide, and moulding 4 inches girt

B. round both sides, 4-inch butt hinges, and mortice lock. Fix to ten other doorways 2-inch four-panel square doors, 3 ft. by 6 ft. 8; $1\frac{1}{4}$-inch jambs, and grounds and mouldings both sides, like the last described; five sets of the jambs to be $1\frac{1}{2}$-inch, and to be square framed in three panels.

London Assurance Office.—Fix to the nine doorways 2-inch four-panel moulded two sides doors, 3 ft. by 6 ft. 8; $1\frac{1}{4}$-inch double rebated jamb linings, one set to be framed and moulded, and to be $1\frac{1}{2}$-inch; $1\frac{1}{4}$-inch framed grounds, $4\frac{1}{2}$-inches wide, and single architrave round, 4 inches girt both sides, 4-inch butt hinges, and 7-inch mortice locks.

Unappropriated Offices.—To fix to doorway to flat similar door and fittings, as described before. (See A. above.) To fix to the other two doorways doors and fittings as described before. (See B, above.)

One-Pair Story: Lloyd's Rooms.—To fix in reading room and secretary's room two wainscot doors, and one blank door of wainscot to match, 3 ft. 4 in. by 8 feet, to be $2\frac{1}{2}$-inch double margined doors, moulded both faces; four sets of $1\frac{1}{4}$-inch deal grounds, 7 inches wide, and wainscot architraves 12 inches girt; $1\frac{1}{4}$-inch wainscot rebated linings, 7 inches wide to two, and narrow ditto, to match, to the blank door; each door hung with $1\frac{1}{2}$ pair 5-inch brass butts, and fix mortice locks £1. 1s. in value, prime cost exclusive of fixing. To fix to four other doorways in clerks' room and bar, $2\frac{1}{4}$-inch deal four-panel moulded both sides doors, one to be a sash door, $1\frac{1}{2}$-inch deal rebated jamb linings, $1\frac{1}{4}$-inch grounds, and moulding $3\frac{1}{2}$-inch girt on six faces, $4\frac{1}{2}$-inches butt hinges and 7-inch mortice locks with horn furniture. Fix to the large doorways leading into the two great rooms, 3-inch wainscot ten-panel folding doors, moulded both sides, with raised panels in two heights, hung with 5-inch brass butts, three to each fold, with concealed joints, and burnished knuckles and flaps; and fix to each pair of doors lock and furniture to cost £3 exclusive of fixing and profit; and two 18-inch and two 54-inch brass flush bolts, $1\frac{1}{2}$-inch wide; the linings to be $1\frac{1}{2}$-inch wainscot, moulded to match, in 14 panels and rebated; and fix on both faces of each, on proper deal grounds, $1\frac{1}{4}$-inch wainscot keyed ground with mitred angles and returns, tongued to deal grounds, glued and blocked; and fix on these wainscot grounds moulded architraves, 16 inches girt, with extra mitred angles and wainscot cornices, 33 inches girt, with mitred returns and deal cover boards and bearers. The friezes formed of the wainscot grounds to have cut ends of the prime cost value of 12s. each. Fix to large doorways into captains' room, 3-inch folding doors to match the last described, with plain $1\frac{1}{2}$-inch rebated and keyed linings, and $1\frac{1}{4}$-inch deal grounds 10 inches wide on both faces, and wainscot architrave 16 inches girt; hinges as the last, and fix a lock of prime cost value of 50s. exclusive of fixing. Fix to the two similar doorways in the commercial room $2\frac{1}{2}$-inch wainscot, four-panelled, double margin, folding doors, moulded on both faces; $1\frac{1}{2}$-inches wainscot rebated and staff beaded and jamb linings; $1\frac{1}{4}$-inch deal grounds to one face of each doorway, and wainstcot architraves 10-inches girt; also small wainscot frieze 8-inches wide, and moulded caps 10-inches girt, with proper deal grounds; the doors hung with $4\frac{1}{2}$-inch brass butts, and fix to each a mortice lock with horn furniture.

Fix across the great room, and to form lobbies adjoining, a screen and partitions with doors, as is shown in drawings Nos. XVIII. and XIX., and containing the following work, all to be executed with fine grained wainscot.

Ft.	In.		
78	0	sup.	$1\frac{1}{4}$-inch glued and mitered pilasters.
42	0	„	2-inch glued up diminished pillars, 10-inches diameter.
108	0	„	$2\frac{1}{4}$-inch astragal and hollow sashes.
505	0	„	$2\frac{1}{2}$-inch moulded and raised panels, two sides partition, two panels high.
60	0	„	$2\frac{1}{2}$-inch four panel-doors to match.
50	0	sup.	$2\frac{1}{2}$-inch two-panel sash doors to match, with semi-heads, folding, and in two heights.
402	0	„	Mouldings.
30	0	„	Do. circular.
104	0	„	Mouldings in short lengths, straight.
310	0	run	Rebate.
140	0	„	Cross rebate in short lengths.
184	0	„	Labour to rebate and angle bead.
118	0	„	Groove.
218	0	„	Tongued joint.
244	0	„	Mitred angle, glued and blocked.
130	0	„	Small mitred fillet for plate glass.
96	0	„	Mouldings $1\frac{1}{2}$-feet girt.
76	0	„	Do. $2\frac{1}{2}$ do.
82	0	„	Do. $3\frac{1}{2}$ do.

No. 104 Mitred angles to moulding, averaging 9-inches girt.

	£	s.	d.
Allow for carving and other works, prime cost............	100	0	0
Allow for ironmongery to ditto prime cost............	12	0	0

C. Royal-Exchange Assurance.—To fix to four doorways of court room and committee room $2\frac{1}{2}$-inch wainscot four-panel double margin doors, 3-feet 6 by 8-feet, moulded with raised panels both sides, to be hung each with $1\frac{1}{2}$ pair 5-inch brass butts, and fix mortice locks of the prime cost value of 30s. each; $1\frac{1}{4}$-inch wainscot double rebated jamb linings, $1\frac{1}{4}$-inch deal grounds, 6-inches wide, and wainscot architraves 12-inches girt, and allow £15 for friezes and caps to five door faces. To fix in committee room $1\frac{1}{4}$-inch blank wainscot door to match, with similar deal grounds and wainscot architrave.

E. To fix to two small doorways in governor's private room, (2-feet 6 by 7) $1\frac{1}{2}$-inch wainscot moulded and bead flush four-panel doors, $1\frac{1}{2}$-inch deal rebated jamb linings and mouldings round, $4\frac{1}{2}$-inches girt on narrow grounds to three faces; doors to be hung with 4-inch brass butts, and fix to one 7-inch mortice lock and horn furniture, and to the other 6-inch dead lock, with mortice furniture to match.

D. To fix to the fifteen other doorways 2-inch wainscot doors (3-feet 3-inch by 7-feet 6) four-panel moulded and bead flush, hung with $4\frac{1}{2}$ inch brass butts to $1\frac{1}{2}$-inch deal double rebated jamb linings, and fix on both faces of each $1\frac{1}{4}$-inch deal grounds five inches wide, and moulded architraves 10-inches girt (excepting one door to small staircase, which will require grounds and moulding on one face only); 7-inch mortice locks with horn furniture.

To fix round door to strong room, which will be iron, jamb linings, grounds, and architraves to match. Two sets of the jamb linings must be extra framed in three panels, finished bead flush.

London-Assurance Offices.—Fix to the five doorways in court room, committee room, and governor's room, wainscot doors, fittings, and ironmongery as before described and included in bracket C, and including £15 for extra work to five door faces.

To fix to seven other doorways, doors and fittings, including ironmongery, like those before described and included in bracket D.

To fix doors and fittings on landing, 14-feet 4-inches wide, and 14-feet 6-inches high, as follows:—The opening to have elliptical arched head, 5-feet high, included in the 14-feet 6-inches, Three-inch wainscot grounds prepared for folding doors, 10-feet by 5, and two pieces of sash framing 10-feet by 4-feet 2, to match. Wainscot moulding 9-inches girt on each face; the doors to be folding, $2\frac{1}{4}$-inch wainscot, one-panel, bead flush, two sides, sash doors with diminished styles, hung with brass swing hinges, and fix to them four handsome bracket handles; to be glazed with four sheets of plate glass, 37-inch by 24, secured with wainscot fillets, mitred and screwed. The sash framing each side to be $2\frac{1}{4}$ inch wainscot to match, glazed with 8 sheets of plate glass 37 inches by 23. Fix in head wainscot frame 3-inch by $3\frac{1}{2}$, grooved and rebated, but no sill, and three pieces of $2\frac{1}{2}$-inch wainscot sash framing to match, rebated and beaded at the joints, and glazed with seven

sheets of patent polished sheet glass: and allow the sum of £10 for extra fittings to these doors and partition.

Fix in addition on inner face 1½-inch wainscot stop, staff beaded and tongued, to be carried round elliptic head. To fix to the other doorways on landing (5-feet 4 by 13-feet 2) doors, 5-feet by 10-feet, hinges, handles, and glass, like the last described; and 2½-inch wainscot grounds, and wainscot moulding 9-inches girt on each face. Fix over 2¼-inch wainscot sash with circular head, and glazed with five sheets of polished sheet glass. Wainscot frame 5inch by 4, with semi-head, 1¼-inch wainscot plain tongued and staff beaded linings on both sides.

F. The three large doorways in fire-office and secretary's room to have 2½-inch wainscot, one-panel, bead flush, two sides, sash, folding doors, diminished styles, hung with swing hinges, and fix four bracket handles to each pair; glazed with four sheets plate glass, 33-inch by 23, to each pair of doors; wainscot frame 5-inch by 4, and 1¼-inch wainscot, tongued, and staff beaded linings on both sides, 2½-inches wide, to two doorways, and 6½-inches wide to the others.

Unappropriated Offices.—The entrance doorway on landing, 13-feet 2 by 5-feet 4, to have doors, glass fittings, and ironmongery as the last described within bracket F, with semi head. The three doorways in board room and committee room to have wainscot doors, fittings, and ironmongery, as described before and included in bracket C, and allow £12 for extra fittings to the same; one set of the jambs will be extra moulded in four panels to in this the soffits having two panels, and being double margined. Fit up match, board room one wainscot blank door, and fittings to match.

The five other room doorways to have wainscot doors and deal fittings and ironmongery, as described before and included in bracket D. The small door to staircase to have wainscot door fittings and ironmongery, as described before and included in bracket E.

Ground Story: Lloyd's Rooms.—The entrance doorway from east area to have oak doorcase, 6 inches by 6, extra moulded on the outer edge, and 3 inch wainscot six-panel folding doors, moulded and bead flush; the upper part fixed, the lower part hung with three pair of *Redmund's* 6-inch brass butts with knuckles, and fix to them one 12-inch and one 30-inch brass flush bolt 1½ inch wide; also a lock 50s. in value, and two brass knobs 21s. value each. The panels in upper part open for glass, and glazed with plate glass. To fix on doors wainscot mouldings nine inches girt, to form mullion and transom, and sink the doors out for them. Fix in arch over, oak semi-frame, 6 inches by 4, and 2½-inch wainscot sashes, in three pieces, glazed with sheet glass; the midlde divisions rebated and beaded, and hung with 3-inch brass butt hinges, with brass knob turnbuckle fixed thereto. Fix in front of fan ornamental guard, which with pattern is to be of the prime cost value of £25.

G. Royal Exchange Assurance.—Fix to entrance doorway from western entrance to Exchange, 2½-inch wainscot three-panel folding doors, 5 feet 6 by 9 feet 4, moulded with carved panel on face and head, flush back, hung with three pair 4½-inch brass butts to oak doorcase, 6 inches by 5, with transom, and semi head and wainscot moulding on transom, 9 inches girt; moulding 3½ inches girt on frame. Fix to doors one 12-inch and one 36-inch strong barrel bolts, and a capital mortice rebated lock, with bronze furniture inside, and two large bronze knobs on the outside; brass door-chain and barrel, metal fan-light glazed. Fix round inside 1½-inch wainscot tongued linings, finished with staff bead.

H. Fix in doorway from staircase to office (10 feet by 5) 2½-inch wainscot, one-panel, moulded, two sides, folding sash doors, with diminished styles, in two heights, the upper height fixed, the lower height hung with patent swing hinges; wainscot frame 5 by 3, moulded on both edges, and fix on each side 1½-inch deal tongued and staff beaded linings; the doors glazed with plate glass, two sheets 42 inches by 24, and two sheets 24 inches by 24. Fix to doors four bronzed bracket handles.

Fix in inner doorway in south entrance (8-feet 8 by 10-feet 4), with arched head, 2½-inch wainscot partition and sash folding doors with semi head; the doors, fittings, ironmongery, and glass, like the last described; the partition moulded to match; semi metal fanlight 5-feet diameter, glazed, over doors. Fix to jambs on south side 1½-inch deal keyed staff beaded and tongued linings: the head stucco. Fix on north side 1½-inch deal staff beaded stop, tongued on; the sides of partition framed and moulded in three panels; the circular margin also to head framed and moulded in three panels to match.

Banking-house, North-west Angle.—Fix to south entrance doorway from portico, doors, frame, fanlight, fittings, and ironmongery, as described to doorway opposite, and included in bracket G.

Fix to two doorways in Banking-house (averaging 4-feet 8 by 12-feet 10) wainscot doors and fittings complete, as described before, and included in bracket H, including ironmongery; but the heads to be semi, and the wainscot frame continued round, but without linings, as stucco will be substituted to the semi heads; the doors 7-feet 6 high; plate glass in doors 42-inch by 22, and four squares in each; upper part of plate 29-inch by 22, cut to shape.

Fix to the five smaller doorways 2¼-inch wainscot doors, 3-feet by 7-feet 6, four-panel, moulded both sides, hung each with 1½ pair of 4½-inch brass butt hinges to 3-inch wainscot rebated frames, 5-inches wide; and fix 1½-inch deal tongued and staff beaded linings on each face, to make up width of jambs; 1¼-inch deal grounds 6-inches wide, and deal moulded architraves, 10-inches girt, on sides next rooms only; 7-inch mortice locks, with horn furniture.

Fix in front of staircase doors and partition (7-feet 9 by 14-feet 3), including door, 3-feet 3 by 7-feet 6; sash over 3-feet 3 by 5-feet; sash framing each side 12-feet 2 by 1-foot 10½. Wainscot frame 5 by 3, with muntins, heads, and transom to door only, all to be rebated and staff beaded; 2¼-inch wainscot four-panel moulded and bead flush door, and the framing each side one-panel moulded to match, with diminished styles; three sheets of plate glass 36 by 18 on each side; 2¼-inch plain fan sash over door, glazed with two sheets of plate glass 54-inch by 9, and one sheet 54-inch by 17. Wainscot moulded plinth both sides of partition and round frame, mitred, 4-inch by ¾. Wainscot keyed fascia 10-inch by 1¼ both sides, with rebate for plaster cornice, narrow wainscot soffit filled in between frames; 7-inch mortice lock, with bronzed furniture; the door to be framed, double margined, and to be hung with 1½ pair of 4-inch brass butts.

Fix to four doorways to Shops in East Entrance under tower, 2½-inch wainscot sash doors, 3-feet 4 by 8-feet 6, glass, shutters, and ironmongery as will be described for the shop doorways; oak door-case, 5-feet by 5, with moulding on edge; no linings inside. Fix to four doorways inside shops in east façade 2-inch deal four-panel bead flush two sides doors, 2-feet 9 by 7-feet; 2-inch deal three-panel bead flush jamb linings, rebated and finished with staff bead on both edges; 4-inch butt hinges; 7-inch mortice lock.

Fix to doorway to porters' room in Ambulatory, 2½-inch wainscot bead flush two sides sash door (3-feet 4 by 7-feet 6), with diminished styles, glazed with sheet glass, and hung with 1½ pair of 4½-inch brass butts, to proper oak door-case 5-inch by 6, with transom and semi head. Above fix a metal fanlight, glazed, and fix round inside 1¼-inch tongued and staff beaded stop, continued round head; 1¼-inch wainscot shutter to match; two brass nuts, one brass lifter, and two brass studs and plates; one 7-inch mortice lock with bronze furniture.

Mezzanine Story: Royal-Exchange Assurance.—Entrance doors to office, 5-feet by 8-feet 6; 2½-inch one-panel bead flush and moulded wainscot folding sash doors, hung with *Smith's* patent swing hinges, rounded edges, not diminished styles. One square of plate glass, 21-inch by 54 in each fold, and wainscot fillets screwed; four bracket handles; wainscot frame 5 by 4, hollowed for doors, and grooved for linings; 1¼-inch wainscot, keyed, tongued, and staff beaded linings, 10-inch wide, as staircase; side grooved for stucco; 1¼-inch deal plain tongued do. 6½ wide on inner side; 1¼-inch grounds, 6-inch wide, and deal moulded architrave, 6-inch girt; lintel 18 by 8; eight wood bricks.

Doors in Small Office.—One 2¼-inch four-panel moulded and bead flush

wainscot door, 3-feet 2 by 7-feet; $4\frac{1}{2}$-inch brass butts; $1\frac{1}{4}$-inch single rebated wainscot keyed jamb linings, staff beaded on side next landing; $1\frac{1}{4}$-inch deal grounds, 5-inches wide, and moulded architrave, 6-inches girt; mortice lock and bronze furniture; lintel 18 by 4; eight wood bricks.

The other door, $2\frac{1}{4}$-inch four-panel wainscot moulded and bead flush door, 3-feet 2 by 7-feet; $4\frac{1}{2}$-inch brass butts; $1\frac{1}{2}$-inch plain deal keyed jamb linings, rebated and rounded both edges; $1\frac{1}{4}$-inch grounds, 5-inches wide, and moulding 6-inches girt, both sides; lintel 18 by 4; eight wood bricks; mortice lock.

Banking-house, North-west Angle.—Three of the doors to be 3-feet by 6-feet 8; 2-inch deal, four-panel, moulded and square; 4-inch butt hinges; mortice locks; $1\frac{1}{2}$-inch jamb linings, rebated one edge, rounded two edges; $1\frac{1}{4}$-inch grounds, $4\frac{1}{2}$-inches wide both sides; moulding $2\frac{1}{4}$ by $1\frac{1}{4}$ one side, and architraves 6-inches girt the other; partition 5-inches; jambs $7\frac{1}{2}$-inches wide. The other doors 3-feet by 6-feet 8; 2-inch deal, four-panel, moulded two sides; jambs as last, rebated one side, 1-foot $8\frac{1}{2}$-inches wide, to be $1\frac{1}{2}$-inch, and moulded in three panels; hinges, locks, and grounds as last, and moulding 6-inches girt both sides.

L. Basement Story: Royal-Exchange Assurance Department.—Three inner doors 3-feet by 7, 2-inch four-panel square; $1\frac{1}{2}$-inch rebated linings, rounded one edge and keyed; one set of grounds $4\frac{1}{4}$ by $1\frac{1}{4}$; two sets of mouldings $2\frac{1}{2}$ by $1\frac{1}{4}$; 4-inch butt hinges; 7-inch best three bolt rim lock.

M Four doors to coal vault, 3-feet 4 by 7-feet; $2\frac{1}{4}$-inch four-panel square; proper oak frame 5 by $4\frac{1}{2}$; moulding one side; 8-inch dead lock.

I. Two sash doors and sashes over to external walls, 4-feet 6 by 10-feet; 2-inch one-panel bead flush and square folding ovolo sash doors 4-feet 6 by 7-feet net; diminished styles; glass 3-feet 6 from floor; proper oak frame 4 by $4\frac{1}{2}$, and transom 4 by 3; 2-inch ovolo plain fan sashes 4-feet 6 by 2-feet 9; 4-inch butt hinges; one 8-inch and one 18-inch barrel bolt; one 8-inch two-bolt rim lock. Fix round inside plain tongued and splayed linings, and single architrave. Allow £1 each for adapting these two doors to office fronts over.

K London Assurance.—One door and sashes 8-feet 9 by 10-feet; door 3-feet 3 by 7-feet; $1\frac{1}{2}$-inch bead flush panel over; two sashes and framing 2-feet 6 by 10-feet; the door 2-inch bead flush and square; 4-inch butt hinges; 8-inch two-bolt rim lock; 2-inch bead flush and square sash framing, with diminished styles; glass 3 feet 6 from floor; oak door case $4\frac{1}{2}$ by 4; two muntins; one transom over door, filled in with $1\frac{1}{2}$-inch bead flush and square panels; $1\frac{1}{4}$-inch plain tongued linings splayed; single architrave $2\frac{1}{2}$ by $1\frac{1}{4}$.

Lloyd's Rooms.—One pair of folding doors 4-feet 6 by 8; $2\frac{1}{2}$-inch one-panel bead flush and square folding sash doors, flat arched heads; glass 3-feet 6 from floor; diminished styles; three pair $4\frac{1}{2}$-inch butt hinges; one 24-inch barrel bolt; one 10-inch lock; oak door-case 5 by 5; $1\frac{1}{4}$-inch beaded stop inside.

One sash door and fan, 3 feet 3 by 10, like that described in bracket I, complete; no inside lining.

One door 3 feet 6 by 7 feet 6; $2\frac{1}{2}$-inch four-panel bead flush and square; $1\frac{1}{2}$ pair $4\frac{1}{2}$-inch butt hinges; flat arched head; oak door-case 5 by 5; one 9-inch rim lock; $1\frac{1}{4}$-inch bead stop next staircase.

Banking-house, North-west Angle.—One door as I, complete. Two doors as L, complete. Two doors as M complete.

Unappropriated Offices, North Side.—One door, &c. complete, as K.

Doorways to Basements of Shops.

Thirteen doors complete, as I; those to circular corners to be framed straight. Seventeen doors complete, as K. Two doors 4 feet 6 by 8 feet, flat arched heads; $2\frac{1}{2}$-inch one-panel bead flush two sides sash door, diminished styles; glass 3 feet 6 from floor; $1\frac{1}{2}$-inch keyed jamb linings, rebated both edges, rounded one edge; grounds $4\frac{1}{4}$ by $1\frac{1}{4}$ one side; moulding two sides; one 9-inch, one 24-inch bolt; 10-inch lock; three pair 4-inch butt hinges. One door 3 feet 3 by 7 feet; $2\frac{1}{2}$-inch two-panel bead flush and square sash door; $1\frac{1}{2}$ pair $4\frac{1}{2}$-inch butt hinges; 8-inch two-bolt rim lock; $1\frac{1}{2}$-inch keyed linings; grounds one side; moulding two sides; and other works as the last.

Great Vault.—Two doors 3 feet 6 by 8 feet with semi head; $2\frac{1}{2}$-inch wainscot two-panel bead flush two sides sash doors; one pair 5-inch brass butts; mortice lock 25s. prime cost; oak doorcase 6 by 5; $1\frac{1}{4}$-inch beaded and tongued stop on staircase side.

Shop Fronts, including Circular Windows above.

Nine on the South Side, like drawing, and as follows:—A skeleton frame for door and sashes, made out of the best *Riga* fir; muntins 9 by 5, and part 9 by $4\frac{1}{2}$; styles, 9 by 4; sill to circular window, 9 by $2\frac{1}{2}$; semi head, 9 by 4; semi transom, 9 by 5; all wrought, rebated, and beaded, and the sill sunk; rough framed transom, 9 by $4\frac{1}{2}$, and four uprights, $4\frac{1}{2}$ by $2\frac{1}{2}$, framed in between it and sill; $1\frac{1}{2}$-inch rough fillet, to carry ends of floor-boards. Moulded entablature, with $1\frac{1}{4}$ inch cover board, and with cut scrolls fixed on; the frieze $1\frac{1}{4}$ inch keyed, on backings, and rebated both edges for mouldings; the upper and lower mouldings to mitre round styles and muntins, which are to be rebated for that purpose. Six cut trusses, and moulded blocked heads mitred to entablature. Moulded rail dividing shop sash, double rebated and double beaded for upper and lower sashes, and the mouldings on upper edge to be mitred round styles and muntins, which are to be grooved for it. Moulded transom for door, double rebated and double beaded in the same manner, $3\frac{1}{2}$ inches high, 5 inches wide; $1\frac{1}{2}$ inch bolection moulded window backs, rebated both edges; $1\frac{1}{2}$-inch moulded plinth and backings, scribed to foot paving, and mitred round styles and muntins, which are to be grooved for moulding. The ends of window backs to be tongued into styles and muntins. Moulded surbase and capping mitred round styles, and muntins to be sunk for it. Quartering to window backs framed to styles and muntins; heads and sills 3 by 3; three uprights 3 by $2\frac{1}{4}$; bearer 4 by 2, spiked to inside of styles and muntins, to carry ends of flooring-boards. The door to be $2\frac{1}{2}$-inch wainscot one-panel bolection moulded and bead flush inside sash door, with diminished styles, and $1\frac{1}{2}$-inch wainscot two-panel bead flush and square lifting shutter; the door hung with three 4-inch butt hinges, and to have a capital two bolt 7-inch mortice lock, with large bronze handles, and two 10-inch bright barrel bolts. Fix to shutter iron heels screwed, brass lifter, two brass studs and plates, and two brass thumb-screws and plates. Fill in the six lower compartments with $2\frac{1}{2}$-inch wainscot moulded sashes, and wainscot rounded fillet round each. The two lower compartments are to have five $1\frac{1}{2}$-inch deal three-panel bead flush and square lifting shutters; fix to each two iron heels screwed, two iron studs and plates, and a flush lifter; also neat chamfered wrought iron shutter-bar, with mortice plates, bolts, nuts, and thumb-screws. Fix in the semi heads 2-inch metal lights, with $2\frac{1}{2}$-inch rims; the glass to the whole to be the best flatted sheet glass. Fix inside $1\frac{1}{4}$-inch tongued and staff beaded linings grooved, for plaster and wall linings; the linings saw cut and bent round semi head, and an extra straight soffit to match shop ceiling, and $1\frac{1}{4}$-inch fascia tongued and grooved, also $1\frac{1}{4}$-inch tongued and beaded filling-in pieces over shop sashes. The torus skirting will continue round in the upper rooms, and fix above $1\frac{1}{4}$-inch plain keyed window back, rebated for torus skirting, and narrow tongued and beaded capping.

The other three will be similar, except parts varied as follows:—The two which contain entrance doorways to offices and staircase to have folding sash doors and shutters the whole height and width of the middle division, to correspond with the others; but the locks to be rebated with double furniture, and one of the bolts to be 30-inches long, and provide a mortice plate, and letting in to stone to one bolt: the remaining part will be all sashes and no door. The window back in the ground story of south-west offices will be $1\frac{1}{4}$-inch three-panel, bead flush; fix $1\frac{1}{4}$inch flush beaded plinth, 7-inches wide, and moulded surbase, 3-inches girt, with narrow capping on it, tongued into sill, making together 2-feet in height. The three upper sashes in this part to be reduced one square in height, and the outside window back to be raised to make the whole height the same. The inside window back in the entrance to the south-west offices will be $1\frac{1}{4}$-inch

one-panel, bead flush, and square; narrow tongued capping, and 1¼-inch flush beaded plinth, 7-inches high. The inside window back in the staircase front will be similar to the last.

To prepare and fix fourteen shop and office fronts to the openings, north side, as is shown in the drawing of one of them; all parts to be similar to those in the south front, except as follows:—The doors will be in the middle, and will require separate door-posts, 7 by 2½, and the moulding in front of transom will mitre round the same, and the window back, inside and out will abut against them. Single shutters to side lights, and small shutters to sashes each side of doorway; these last shutters to be fastened like the shutters to door.

The front to small staircase, and the front to entrance to north-west offices, to have folding doors to occupy the whole size of the single door; sashes, and fan over, with ironmongery, as the others. The inside window backs to be 1¼-inch bead flush, with flush beaded plinth and narrow tongued capping. The upper sashes in the front in private office to have the upper sashes reduced one square in height, and the inside and outside window backs raised to make the whole height the same; they will also be all sashes and no door, and the window back inside to be moulded with moulded capping and plinth, like the window opposite. The linings to staircase front will be wider, and the soffit will be cut to shape above and below. The linings and soffit to the second shop front, east of north entrance, will be wider above and below.

Prepare and fix six shops and office fronts to the openings east end, to be similar in every respect to those described for the side, but varying in dimensions, for which see drawings.

Prepare and fix six other shop fronts to the openings in the north-east and south east circular corners, with all fittings and glass complete (according to drawing No. XXIII.), and constructed like the others, with such variation as the design renders needful.

Prepare and fix seven other shop fronts in east area, and two in passage, from east area to Ambulatory, including all fittings and glass, as they are shown in drawings Nos. XXII. and XXIII., constructed as the others, with such alteration of parts as the design renders needful.

This will make forty-seven in all; and the contractor to execute additional works to these shop fronts, which the architect may order, so the extent of £150 in prime cost value. The contractor is also to execute extra and additional works to the doors, which the architect may order, to the extent in value of £100; and also to provide extra ironmongery, and fix it, to the extent of £25 in value.

Stoves and Fireplaces.—We have no doubt that, "The Housekeeper in search of a Stove," might be made as interesting a volume, as "Cœlebs in search of a Wife,' or, "The gentleman in search of a Horse," assuming only, that the variety of the choice has any weight in the matter. As we should be very sorry to have to make a complete catalogue of all the stoves, which have of late been palmed upon the public, we do not mean to attempt it. We would rather refer our readers to Mr. Bernan's work on the subject, for such a conscientious undertaking, and shall confine ourselves to a consideration of those few novelties, which appear to us to offer any features of importance.—First on our list, we have "Pierce's Patent Pyro-pneumatic pure warm air self-acting and ventilating stove-grate," at the name of which, we beg none of our reader will be frightened, although in a general way, we should feel inclined to lay down the rule that the usefulness of an article is in the inverse proportion to the length of its name; however, now-a-days, where a potato steamer is called "An Anhydrohepseterion," Mr. Pierce may be excused for attempting to present all the advantages of his stove grate at one view. But, to come to the point, we must analyze the claims of the Pyro-pneumatic to our consideration. It is, first, an open fire place. We think we see the countenance of our reader brighten at this announcement, in anticipation of that well-aimed blow with the poker, (which instrument curiously enough, every one believes he can handle with greater skill than any and every body else, without exception;) which breaks up the devoted lump of coal, producing that cheerful blaze, the satisfaction at which, as expressed on the countenance of the operator is of an extent proportionate to the goodness of the action. Whether from custom, or from some peculiar instinct, certain it is, that an Englishman never fails to grumble, unless he can see and poke the fire.

A residence in Paris will tend to shake his notions as to to the economy of an open fire-place, and a winter farther North, will probably lead him to allow that custom must conform to climate, but the feeling is as strong as ever in this country, and has operated more effectually than anything else against introduction of close stoves.

The next feature of the Pyro-pneumatic is, that the whole of the interior of the stove is composed of fire-brick, the bars of course excepted, so that no contamination of the air, from exposure to iron highly heated, can take place. The ornamental casing may also be made of glass, tiles, or similar material, if preferred to cast iron.

We briefly noticed, (in our last number) the advantages which may be derived from using fire-places lined with firebrick in preference to iron, so that we need say nothing further upon that point, except that provision is made to replace bricks nearest the fire, without disturbing the rest. The last point is, that the heat is entirely abstracted by the flame passing over a bridge and through a descending flue, heating in its progress the the exterior surface of a number of vertical tubes of fire clay, through which rises a current of air, admitted either from the floor of the room, or the outside of the house. By this means, a large volume of air, moderately warmed, is supplied, and may be carried up to another room, if necessary, or if the stove be placed in the hall, it will assist in keeping the upper rooms and staircases at an equable temperature. For general purposes, we do no know that we could recommend a better stove than this. In our next No. however, we shall have something to say on other stoves, and be able to draw a comparison between them.

Important Conviction under the Wreck and Salvage Act.—A most important conviction, resulting in the committal to goal of the master of a steam-vessel, for evading the provisions of the Act 9th and 10th Victoria, chap. 99, known as the Wreck and Salvage Act, has just taken place at Newmarket, in Flintshire. The decision in this case is one of great importance to the maritime interest, and cannot be too generally known by masters and commanders of vessels. It appears that the Taliesin steamer, plying between Liverpool and Rhyl, on her passage between the above ports, on the 9th of January last, fell in with an abandoned vessel which proved to be the Dasher, of Killough, in Ireland, laden with oatmeal, and bound for Liverpool. This wreck was taken in tow by the steamer, and was safely brought into the river Dee, where she was stranded near Mostyn Quay. The master of the steamer reported the circumstances to his employers, the Messrs. Eyton, of Mostyn Colliery, but neglected doing so to the Receiver of Droits of Admiralty for the district, as required by law. The Messrs. Eyton took measures for saving as much of the cargo as possible, and they transmitted a full narrative of the circumstance, to Lloyd's agent at Liverpool, and to the owners of the Dasher at Killough A small schooner was laden with the recovered property, value £150, which was forwarded to Liverpool by Messrs. Eyton for the benefit of the underwriters, by whom it had been claimed. The remainder of the cargo was plundered, and carried away by a number of lawless depredators. For the non-compliance with the provisions of the act, in thus neglecting to place the vessel and cargo at the disposal of the Receiver, Hugh Jones, the master of the Taliesin, was summoned by Captain Tarleton, the Receiver of Droits, before the magistrates at Newmarket. The case was fully entered into, and the fact of the non-reporting to the Admiralty officers clearly established. The magistrate inflicted the penalty of £100, which sum they had no discretionary power to mitigate. In default of payment, the master was sensenced to six months' imprisonment. It may not be generally known that all goods and articles cast up by the sea, or secured as derelict on the waters, are immediately to be reported in writing, as such, by the salvors to the receivers for the Admiralty. The act is most stringent and decisive on this point. In the above instance had the master properly reported the case, he would have been entitled to a large sum as salvage.

NOVELTIES.

HJORTH'S ELECTRO-MAGNETIC ENGINE.—Our readers will remember that as long ago as October last, we gave an outline of this invention. Mr. Hjorth has now an engine, the magnets of which are capable of sustaining 4764 lbs., which is sufficient to show that the engine is something more than a mere model. We look forward to a trial of the economy of this engine with great interest, as the arrangement appears to us the most feasible yet proposed. We may here remark that a committee, appointed by the Senate of the United States to report on a plan by Dr. Page, for the use of magnetism as a motive power, have resolved that 20,000 dollars should be applied to test his invention.—No wonder the Americans go-a-head, when native ingenuity is thus encouraged.

THE INDIAN RAILWAYS.—Our readers will, we are sure, participate in our satisfaction at the arrangement which the East India Company has offered to the Indian Railway Companies.—A guarantee for 25 years of 5 per cent. interest on the capital expended, with the privilege to the Companies of handing over the lines, at cost price, to the India House at any time, upon giving six months' notice, are the main points. The only contingencies involved may be explained as follows:—1. The guarantee is in each case to apply to a specified amount of capital, based upon the estimates (already prepared) of the cost of construction; and if these amounts be exceeded, the shareholders will, of course, to that extent be unprotected. 2. The guarantee is to be for 5 per cent interest, not dividend; so that if the working expenses should in any degree go beyond the receipts, the deficiency will have to be made up out of this allowance. 3. The India House are to have the right of taking the lines at the end of 25 years, at the average price of the shares for the three preceding years.

VOCAL PHENOMENON.—The *Globe* describes an extraordinary case of vocal powers, produced by Dr. W. V. Pettigrew at one of his lectures on physiology in the School of Medicine, adjoining St. George's Hospital. To his hearers he presented Mr. Richmond, who possesses the faculty of producing two vocal sounds at the same time, and these in harmony. Mr. Richmond commenced by producing a modulated bass tone, according to Dr. Pettigrew's opinion, in the upper part of the pharyngeal and nasal cavities, and almost instantly a treble accompaniment, which the lecturer had no doubt was produced by the vibration of air over the thin and expanded edges of the tongue, the vibrations being manipulated by the most adroit management of the muscles of that organ. The treble tones cannot be produced unless the tongue be fixed at its base to the hyoid bone, and by its apex to the roof of the palate; and were of the sweetest and most melodious character far surpassing in softness any known musical instrument, or even vocal organ of the bird. From a very crowded theatre, consisting of students, many of the most eminent physicians and surgeons and numerous scientific gentlemen, this performance elicited enthusiastic applause.

BEHRING'S STRAITS.—The latest accounts from this quarter are derived from a Captain Rays, of an American whaler, who fished there (as high as 70° lat.) to the end of August. He states that, during the entire period of his cruise of about seven weeks, no ice was seen; the weather was ordinarily pleasant. It was not difficult 'to whale' the whole 24 hours; so light was it that at midnight it was easy to read in the cabin. The whales were quite tame, and different from any which Captain Roys had before taken. He took three different species, one of the largest yielding 200 barrels of oil. The first much resembled the Greenland whale, yielding 160 or 170 barrels; the second was a species called Polar whale, a few of which have been taken on the north-west coast; and the third, a small whale peculiar to that ocean.

Two miserably poor young men, of an obscure village in the department of the Isére, have succeeded, after ten years' laborious exertions, and in spite of discouragements innumerable, in completing a calculating machine, which is represented to be far superior to that of Babbage, or any other yet invented. It has just been examined by the Academie des Sciences, and a most eulogistic report on it has been presented. A detached description of it, with illustrations, is to be forthwith published in the Academy's records. It will, it is asserted, work any calculation in an incredibly short space of time—twenty seconds, for example, sufficed to multiply 2749 by 3957.

SWEET OIL OF TURPENTINE.—We have tested a sample of this new article, and find it even a better painting article than the stinking stuff which we have been so long in the habit of submitting to. For the interior of dwelling-houses, we imagine it will be found a great desideratum.

SUPPLY OF WATER TO AMSTERDAM.—A company, managed by a board in London, is being formed, with a capital of £600,000, in 30,000 shares of £20 each with £2 per share deposit, to supply Amsterdam with water from the Rhine. The privilege has been conceded in perpetuity to this company, who are to be entitled to a maximum charge of twice the amount believed to be capable of yielding a return of 24 per cent. The responsibility is limited, it is said, to the amount subscribed.

FOULNESS ISLAND.—Foulness Island in the county of Essex, was recovered from the sea at an enormous expense of capital. The recovered territory was defended from a second invasion of the water by a wall which completely encompassed the Island. A few weeks since, the sea, recommenced its ravages upon the Island, the wall yielded to the length of 120 feet. By the aggression of one night's tide, 700 inhabitants were threatened with instant destruction, and about 6000 acres of rich corn land seemed doomed to be again appropriated by the sea. Captain Bullock, R. N., of the surveying service, being in the neighbourhood of the calamity, was appealed to for assistance by the Marsh Bailiff. This gallant officer lost no time responding to this appeal to his humanity—he ran his vessel the Wigeon steamer, into the breach made by the sea, and having moored her broadside on to the bank so as to become a complete, breakwater, he had the satisfaction of saving a whole population from instant death, and a large extent of valuable land from certain destruction. The breakwater thus hastily conceived and as hastily constructed answered admirably to the object intended. Hands were immediately set to work to erect an inner embankment. Captain Bullock in responding to this appeal to his humanity, laid himself open to provoke the displeasure of the Lords' Commissioners of the Admiralty, who however, on receiving Captain Bullock's report, approved of Captain Bullock's intrepid promptitude of conduct, and aided his useful endeavours by obtaining the aid of 60 sappers from Sheerness, with three officers, who soon successfully completed what Captain Bullock had began. The promptitude and presence of mind of Captain Bullock on this occasion cannot be sufficiently commended and admired. Another tide without his aid, would have covered the land with seven feet water.

A proposition has been laid before the Senate of the United States to construct a telegraphic communication through the Atlantic Ocean, from the coast of Newfoundland to the nearest cape of Ireland.—The projectors say, there is reason to believe that a sub-marine bank of table land extends from Newfoundland to the capes of the British Channel; and they ask an appropriation and the use of a public vessel, with the necessary appurtenances, for testing the correctness of this theory. They intimate that if they can get soundings, they have only to anchor buoys for stations ten miles apart, and to support the wires between in cork tubes. And even if they do not find soundings, they could still manage to anchor the buoys by means of buckets, &c. The distance between the nearest points of land, they say, is only nineteen hundred miles. The petitioners close with an exhortation to congress "not to allow the British Government to anticipate the United States in this sublime project." The New York *Evening Post* remarks as a consequence of the daily marvels amid which we live, that the Senate received the proposition without surprise—and adds its opinion, that if a line had been proposed to the moon, the project would have had a serious and respectful hearing.

BEQUEST TO INSTITUTION OF CIVIL ENGINEERS.—In the Rolls Court, a decision has just been come to which, if not reversed in a higher tribunal, will confirm in favour of the Institution of Civil Engineers a variety of shares in public companies, &c., bequeathed by Mr. Thomas Telford under his will, but resisted by his heir-at-law under the statute of mortmain.

FRENCH PATENTS.—The revolution of last year so unsettled all monetary affairs in France, that extra delays were obliged to be granted for the fulfilment of various financial engagements, and thus it happened that a law was passed last year, declaring that any Patents, the annual tax on which became due since February 22, 1848, should not be forfeited for non-payment of the annual tax if the tax were paid at such time as should be afterwards notified. The President of the Republic has just issued a decree by which the annual taxes on all Patents, up to that date, must be paid by 1st July, 1849.

INTENSE COLD IN NORWAY.—According to a letter from Christiana, of 1st February, it appears that letters received on that day from Vang, in Hademarken, province of Aggersuns, of the 2nd of January, announce that the cold was so intense (40 degrees, centrigades) that quicksilver became frozen, and that persons who were in the open air lost their breath. Within the memory of man no such phenomenon had taken place in that country.—*Brussels Herald.*

CALCINED GRANITE.—Mr. Archibald M'Donald, of Aberdeen, some time ago discovered a process for reducing Aberdeen granite to a fine clay, which was moulded into form at the Seaton Pottery, and presented an article of a beautiful and durable character. Since then, Mr. M'Donald has had an experiment tried of working the calcined granite into water-pipes.

An American Printer, of the name of Moreton, who died lately, in Paris, is said to have left £4,000, as a premium to any one who shall invent a machine capable of printing 10,000 copies of a newspaper in an hour. If this is open to all the world, Mr. Applegarth will certainly get it, for his machine at the *Times* Office, a description of which we shall give next month.

THE ARTIZAN.

No. V.—Fourth Series—MAY 1st, 1849.

OUR SUGAR COLONIES.

SUGGESTIONS FOR THEIR RELIEF.

In our Number of January last, we noticed a pamphlet by Mr. Henry Crosley, entitled *"Partial Remedies for West India Distress,"* which details various modern improvements contrasted with the almost general modes of manufacturing sugar in the colonies, showing that greatly increased products and of superior quality could be obtained, were the methods, or a part of them, only adopted, whereby the British Sugar Planters would, by their own exertions, alleviate to a considerable extent the distress they are now enduring in consequence of their having to compete with foreign sugars produced by negro slaves, and which advantages it is asserted, can be obtained without increasing the cultivation of the sugar cane.

The direful position of our West India Colonies in a pecuniary point of view, is not propitious for the investment of capital in machinery, apparatus, &c., to effect the improvements in manufacturing sugar to the extent recommended; besides, such operations would require, in the first instance, more attention on the part of those who are intrusted with the management of sugar estates, than the crude modes now practised, which comparatively require but little attention, and therefore, unless managers have ability, and also the inclination to co-operate cordially in carrying out and effecting the improved methods suggested, the result would be, as it has been, but partial success in some instances, and in others the condemnation of the machinery and apparatus. Thus by ignorance or bias in favour of ancient and barbarous customs in the manufacture of colonial sugar, the proprietors of estates are deprived of the beneficial aid of those scientific improvements, which have been completely successful in Europe, and which would in a measure remedy the distress experienced from competition with foreign slave-grown sugar, and the want of that protection which the British colonies formerly enjoyed.

To meet the exigencies of the case, and to obviate the difficulties experienced by the British sugar planter, both as to pecuniary resources and the aid of skilful operators, an attempt has been made to accomplish the *chief* desiderata, viz. *greatly increased products from the juice of the sugar cane, and prevention of the loss now sustained by drainage of the sugar, and the leakage of molasses on board ship on the voyage to England,* estimated at 15 per cent. on the former, and 20 per cent. on the latter. In the pamphlet alluded to, mention is made of a new article denominated Concrete, or a hard substance *combining the sugar with the molasses*; and conceiving that possibly such new manufacture might be deserving of attention, we have been induced to visit the factory of Messrs. H. Crosley, Son, & Galsworthy, where a series of experimental workings have recently been made with cane juice, imported especially for the purpose of converting it into concrete.

Another point deserving of notice, as of considerable importance to the planter, is the extraction of a greater amount of juice from the canes. And in lieu of obtaining, as by the present mode, 10 parts at the most, and generally not more than 8 parts, out of 18 parts on an average, of the saccharine matter in the sugar cane, nearly the whole can be obtained by simple and not expensive means; therefore, if this can be effected, and we consider it possible, the greater portion of the 10 parts of the saccharine matter now wasted and remaining in the sugar canes after they have passed between the rollers of the mill as now constructed and worked, would be available for the manufacture of sugar, &c. On this basis, an estate now making per crop 100 tons of sugar by the ordinary modes employed, would yield from 160 to 180 tons; and be it remarked, *from the same quantity of canes that yielded only 100 tons of sugar.* Again, the loss by drainage of 100 tons of raw, or muscovado, sugar during the voyage is, upon an average, 15 per cent., or a loss of 15 *tons of sugar.* The loss by leakage and bursting of puncheons, on the quantity of molasses *shipped* (for a considerable portion is wasted, and stolen by the labourers,) is about 20 per cent. and estimating that 12 cwts. of molasses is the quantity shipped for each ton of sugar, the weight from 100 tons would be 60 tons of molasses, and the loss thereof at 20 per cent. *would be* 12 *tons.* Therefore, in lieu of those quantities shipped, on arrival in England the losses on the voyage as above stated, would amount to 27 tons.

And the products for sale would be only	133 do.
Shipped in the colonies	160 tons.

The amount, by converting the cane juice into concrete (as waste, lavish use, and pilfering of molasses would be avoided), in place of shipping, say,

100 tons of sugar
60 ditto molasses

160 ditto shipped,

would be 180 tons of concrete; and, as with this there would be no loss by drainage, the difference in the amount of product for sale would

be 47 tons. The non-liability to drainage appears evident, as the concrete we inspected, although made some time ago, and subjected to a humid atmosphere, showed no indication of drainage, it being discharged direct from the teache, or boiling pan, into a wooden box, in which it could be shipped on the following day.

Again, if the greater amount of juice, before alluded to, were obtained from the canes, the amount of produce for sale would be proportionately increased.

Independent of this advantage, another of importance would accrue to the planter. By converting the cane juice into sugar, he is necessarily compelled to skim off the scum, or impurities, arising during the operation of evaporating the juice, although it has been clarified by the usual means, and hence it is estimated that the quantity of sugar is about 12 per cent. less; besides, the subsequent operations of concentrating, and crystallising, and in perfectly curing or draining the molasses from the sugar, require much labour and skill to produce the desired effect. Now, were concrete made, these last-mentioned drawbacks would not exist, as, after a complete separation of all the impurities in the cane juice, and its decoloration by certain ingredients, the so-purified juice can forthwith be concentrated to the degree to form concrete, and without the slightest risk of burning or carbonization in the teache, or boiling pan, and such concrete made direct from cane juice would be superior in colour, approximating to bright yellow instead of brown.

A fiscal question arose before the late Committee of the House of Commons, " On Sugar and Coffee-planting," as to the duty that ought to be paid on the importation of the new article, concrete. It was contended, and justly so, we think, that, as concrete is a compound of the sugar and of the molasses, that otherwise would, in their separate state, pay the proportionate duty of 13s. per cwt. on the sugar, and 4s. 10d. on the molasses, that the duty on concrete should be proportionate thereto, or as represented to the committee, at the rate of 10s. per cwt. of concrete. Without further comment as to the equity of so doing, we conceive that, from the excess of weight as previously stated, and its purity, compared with sugar such as is usually imported (as the juice has been imperfectly cleansed of the impurities) the concrete would sell at remunerating prices.

Another point of importance, which we must not omit to mention, is that the extensive importation of the concrete would create an immense manufacturing business in this country, where we have a greater command of skilled labour and capital, and where fuel, an important item, is cheap. This would arise from the chief demand for sugar being for the article in that state, denominated moist sugar, to which it would have to be reduced.

WATSON AND CART'S PATENT SELF-ACTING CAMPHINE GAS APPARATUS.*

VARIOUS attempts have been made, ever since the general introduction of gas-lighting, to devise a method by which the benefits of its use might be extended to localities in which the consumption was not of sufficient amount to warrant the outlay of the large capital required on the ordinary system. The Portable Gas Company, it will be remembered, undertook to supply receivers filled with gas at a very high pressure, and, by periodically exchanging the empty ones for full ones, to obviate the necessity of having gas mains and service pipes to every house. This plan, however, and some others, though exciting great expectations of success at the time, only served, by their failure, to confirm in the public, a feeling in favour of the established companies, of which their rapid and successful extension is the best proof.

The spirit of progress, however, has not permitted this subject to remain in abeyance. There are now three distinct schemes before the public. Mr. White's—the peculiarity of which consists in using hydrogen gas produced from water, and rendered luminiferous by the use of decomposed tar; Mr. Mansfield's—a description of which will be found in the proceedings of Inst. C.E., in this Number; and Messrs. Watson and Cart's—of which we shall proceed to give description.

FIG. 1.

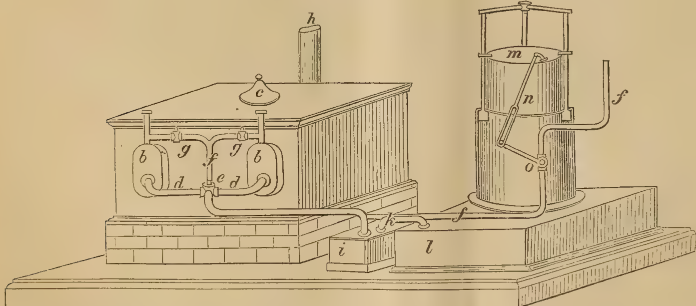


FIG. 2.

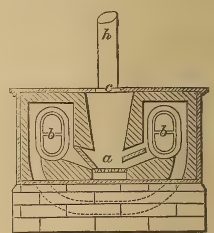


Fig. 1, represents an elevation of the apparatus complete.

Fig. 2, is a section showing the retorts and furnace.

In this apparatus the gas is produced from the decomposition of oil of camphine, and possesses the advantage of requiring but a very slight purification. The trouble attendant upon the working of the apparatus, is sought to be diminished as far as possible, by making the supply of the camphine dependent upon the rate of combustion of the gas, and by so constructing the furnace, that the fire will burn for several hours without attention.

The retorts *b*, *b*, are double—the exterior being of fire clay, and the interior of cast-iron. This method of construction is adapted to enable persons, living at a distance from a town, to replace the loose cast-iron retort, when worn out; and to still further facilitate this operation, the retorts are made of such a size, that one of them will be sufficient to produce the ordinary quantity of gas wanted. Each retort is divided into two, by a diaphragm cast across the retort, in order to expose a greater surface to the camphine.

The retorts are set one on each side of the furnace, which is composed of fire brick, the whole being surrounded by a cast iron casing. The fuel is thrown in at *c*, and burns on the fire bars *a*, provided with proper ash-pit, &c. The draught passes through the damper which is set open, and heats the retort round which it passes, finally escaping through the chimney *h*.

The oil is supplied from a reservoir connected with the pipe *f*, *f*, *f*, and and enters the retort at work, through one of the cocks *g*, *g*.

The gas escapes from the retort through the pipe *d*, which is also furnished

* For abstract of Specification of Patent, see *Artizan*, 1848, p. 274.

with a cock *e*, to prevent the gas escaping into the cold retort, and then passes into syphon box *i*, which forms the hydraulic main. From *i*, the gas passes through the pipe *k*, into the purifier or washer *l*, containing vertical ascending and descending plates, dipping slightly into the water. By this means, the gas is completely deprived of any particles of oil which might have escaped decomposition in the retorts, and been carried over with the gas. Lastly, the gas passes into the gasholder or governor *m*, which does not necessarily require to be of large size, as the gas is being made as it is consumed. It is rather intended to regulate the supply of oil to the retort, which it does in a very simple and efficient manner. Supposing a number of burners to be turned off, and the consumption of gas to be thereby diminished, the governor *m*, will rise, and in so doing, will shut off the cock *o*, on the pipe *f*, through which the supply of oil is admitted, the handle of the cock being connected by the rod *n*, with the governor. A similar arrangement can be applied to diminish the supply of air to the furnace, and so damp the fire. On the consumption of gas being increased, the governor will fall, and increase the production in a proportionate degree.

It is evident, that in some cases, it would be necessary to have a gas holder in addition, although the governor is a necessary adjunct to all oil gas apparatus.

This apparatus has been at work in Hull, for 18 months, lighting a factory there, and we are told, with the most satisfactory results. It has recently been applied at the Harrow Railway Station, and is considered a very great improvement over the former wick lamps. Railway stations, isolated villages, mansions, &c., offer a wide field for its application, of the results of which we shall not fail to keep our readers informed.

DIMENSIONS AND DETAILS OF NEW STEAMERS.

THE BRITISH AND NORTH AMERICAN ROYAL MAIL STEAM SHIP COMPANY'S VESSELS, "BRITANNIA," "ACADIA," AND "COLUMBIA."

	Britannia. Ft. in.	Acadia. Ft. in.	Columbia. Ft in.
Length aloft	206 9		208 5
Ditto keel and fore-rake	206 9	207 3	207 8
Breadth of beam	34 2	34	33 10
Whole tonnage	$1156\frac{45}{94}$	$1148\frac{87}{94}$	$1140\frac{77}{94}$
Engine room	$439\frac{74}{94}$	$431\frac{91}{94}$	$426\frac{67}{94}$

New Measurement.	Feet.	Feet.	Feet.
Length on deck	203·7	202·9	205·9
Breadth on ditto amidships	31·8	30·7	31·6
Depth of hold at ditto	22·2	22·4	22·7
Length of engine room	70·7	70·3	70·1
TONNAGE :—Hull	$1155\frac{491}{3500}$	$1135\frac{98}{100}$	$1175\frac{1863}{3500}$
Engine room ...	$535\frac{246}{3500}$	$523\frac{20}{100}$	$533\frac{3034}{3500}$
Register ...	$619\frac{957}{3500}$	$612\frac{78}{100}$	$641\frac{2917}{3560}$

Side lever engines of 416 horse nominal power. Cylinders 72 inches diameter, 6 feet 10 inches stroke. Extreme diameter of paddle wheels 28 feet 5 inches; effective ditto 27 feet $4\frac{1}{2}$ inches. Floats 6 feet 9 inches × 2 feet 10 inches. Three sets of 21 arms, 16 revolutions per minute. The engines of all these boats are by Mr. Robert Napier, of Glasgow. The *Britannia* was built by Messrs. R. Duncan and Co., Greenock, and the *Acadia* by Mr. John Wood, Port Glasgow. These two vessels, as mentioned in our last number, have been sold to the German Government, and have had their mizen-masts taken out, their saloons taken off the deck, to make room for the armament, and the paddle-box gangways removed, with the exception of the midship ones.

The *Columbia* was lost off Nova Scotia in 1843, the crew and passengers being saved. This, we believe, is the only loss of the kind which this enterprising and successful company has experienced.

THE IRON STEAMER, "LION."

Built and fitted with engines by Messrs. Smith and Rodger, Govan and Glasgow.

	Feet.
Length on deck	183·9
Breadth on ditto	25·7
Depth of hold	14·9
Length of engine apartments...	43·1
TONNAGE.	Tons.
Hull	$608\frac{18}{100}$
Engine apartments	$178\frac{61}{190}$
Register	$429\frac{67}{100}$

Nominal power (2 4-piston rod steeple engines) 256 horse power.

	Ft.		In.
Diameter of cylinders			60 ins.
Length of stroke	4	„	9
Diameter of air pumps	0	„	30
Length of stroke	3	„	0
Diameter of paddle-wheels (extreme)	24	„	0
„ „ (effective)	23	„	4
Length of paddle-boards	7	„	0
Breadth of ditto	2	„	0

Number of arms, 22. Sets of ditto, 3. Draught, light, 7 feet, 30 revolutions. Ditto, loaded, 10 feet, 26 revolutions. 2 tubular boilers, 4 furnaces each.

DIMENSIONS.

Length	14	„	6
Breadth	12	„	0
Height	13	„	0
Length of steam chest (round at back) ...	9	„	0
Breadth of ditto	4	„	0
Height...	4	„	0
Ditto of boiler, including steam chest ...	17	„	0
Length of furnaces	6	„	6
Breadth	3	„	8
Diameter of tubes (malleable iron)	0	„	4
Length of ditto	9	„	0

150 each boiler—total 300 tubes.

DESCRIPTION.

Standing bowsprit, 3 masts, schooner rigged, quadruped figure head ("Lion"), mock quarter galleries, square sterned and clinker built vessel, one deck. Port of Waterford. Station, London and Hamburg, and alternately to Harlingen, with goods, cattle, passengers, &c.

SPECIFICATION OF THE IRON STEAM-SHIP, "LION."

LENGTH between perpendiculars ... ... 185 feet

Fore rake ... ... 8 feet

BREADTH, Moulded ... ... 26 feet 6 in.

DEPTH, Moulded sufficient to give ... ... 14 feet 6 in. clear from top of platform in main hold, to underside of deck at gunwale. To have a flush deck with between decks laid fore and aft, with exception of engine-room, and a round house 20 feet by 20 feet, secured in a substantial manner, and to be similar to the Halifax steamers. To be sponced 3 feet fore and aft the paddle-boxes.

KEEL.—To be hammered iron, 6 in. by 2 in.

STEM.—To be hammered iron, 7 in. by 2 in.

STERN-POST.—To be hammered iron, $2\frac{1}{2}$ in. by 7 in., 6 in. at counter tapering to 4 in. at top, scarphed to keel.

IRON IN HULL.—To be of best Staffordshire plates and angle iron (Thornycroft's to be preferred), rivets in keel and stern-post to be Lowmoor or Bowling, remainder of Thornycroft's best.

FRAMES.—To be angle iron $4 \times 3 \times \frac{7}{16}$. 18 in. from centre to centre throughout.

PLATING.—The garboard strake to be $\frac{9}{16}$, full 60 feet amidships of bottom to round of bilge to be $\frac{1}{2}$ inch. Remainder of bottom and sides to 10 feet water line to be $\frac{7}{16}$. Top sides to be $\frac{3}{8}$ with exception of shear strake, which is to be for 60 feet amidships $\frac{1}{2}$ inch, remainder $\frac{7}{16}$, and not to be less than 2 feet in breadth, the whole to be lap rivetted horizontally, with flush vertical joints.

RIVETTING.—Bottom to 6 feet water line to be double rivetted horizontally, remainder to be single rivetted horizontally, remainder to be single rivetted, except the vertical joints of shear strake for 100 feet amidships, which are to have 4 rows of rivets.

FLOORINGS.—One to every frame to be 18 in. deep of $\frac{3}{8}$ plates, with angle iron $3 \times 3 \times \frac{3}{8}$, running up the bilge to 6 feet waterline in the engine and boiler room; this angle iron is to be continued up to the deck on every alternate frame, in the fore and after holds; every alternate frame is to have a reverse angle iron up to the deck $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$ inch to take the ceiling.

KEELSON.—To have a plate put in fore and aft between the floorings over keel of same depth as the floorings, with a double angle iron $3 \times 3 \times \frac{3}{8}$ running horizontally fore and aft the whole length of the ship, and rivetted to the reverse angle iron of each floor.

STRINGERS.—Main deck angle iron $3 \times 3 \times \frac{1}{2}$ with plate $18 \times \frac{5}{8}$ running all round the ship 'tween decks, angle iron $3 \times 3 \times \frac{3}{8}$ with plates $12 \times \frac{3}{8}$ running all round the ship, to be of as long lengths as possible, joints to be double rivetted to plate put underneath of same thickness, and 12 in. long by breadth of stringer.

PADDLE-BEAMS.—To be 18 in. $\times$ 15 made with angle iron $3 \times 3 \times \frac{1}{2}$ plated with $\frac{3}{8}$ plates, to be kneed fore and aft to the ship's side and wings, and to have diagonal stays underneath, 3 in. diameter, suitable and substantial beams to be put in to secure the engines to.

MAIN AND 'TWEEN DECK BEAMS.—To be of angle iron, main $7 \times 3 \times \frac{7}{16}$ 'tween $6 \times 3 \times \frac{7}{16}$, one to every alternate frame, carlins in proportion, each beam to be secured to the ship's side by $\frac{5}{8}$ iron hanging knees of 18 in. both ways, stanchions to be fitted to every two or three beams, as may be required.

BULK-HEADS.—Four in number, $\frac{1}{4}$ in. plates, well stiffened with angle iron, and to be made fully water-tight.

WINGWALE AND WINGS.—To be framed with angle iron $3 \times 3 \times \frac{7}{16}$, to be made on most approved principles, and furnished with gratings of sufficient strength.

RUDDER.—Best hammered iron, stock $4\frac{1}{2}$ in dia. plated with $\frac{1}{4}$ in. plates.

CUTWATER AND FIGURE-HEAD.—To be distinct from hull (not a clipper bow) knee rails to be of elm with trail-boards, &c. complete, figure-head and all carved work suitable to the name of the ship.

STERN.—To be square, of good breadth, finished in a neat and complete manner, with quarter galleries, stern windows, &c:; ship to be fitted with side ports for ventilation for cattle.

APRON KNIGHT HEADS AND TIMBER HEADS.—British oak of suitable strength. To be covered with iron if required.

WATERWAYS.—American white oak 8×5 in. bolted to outside of plates between every stanchion.

DECK PLANKS.—Main deck 3 in. red pine, 'tween decks 3 in. yellow pine all free from sap, knots and shakes, to be perfectly watertight.

PLATFORM.—Yellow pine $2\frac{1}{2}$ in.

CEILING.—Above platform in holds to be sparred 6×2 in. apart, one spar in each hold to be hard wood, and extra strength for head-roping cattle.

PADDLE BOXES.—To be formed with strong angle iron, plated with iron to range of the bulwarks outside, remainder of wood.

BELTING.—Of elm with bars of iron outside, to prevent chafing.

HATCHWAYS.—Four hatchways on each deck, to have oak coomings, coomings, coomings 18 in. clear of main deck, and 6 in. clear of 'tween decks, one inclined plane to be fitted on each 'tween decks for walking cattle down.

BULWARK.—To be 4 ft. high, with a top-gallant bulwark 18 in., to have an elm rail 4 in. square firmly attached to stancheons at proper height for cattle.

BULWARK STANCHEONS.—To be English oak 6×5 at deck, and 5×4 at top, to go at least 3 feet down.

BULWARK RAILS.—Of American elm, 9×3.

WINDLASS BITS.—Of English oak, and windlass fitted with patent purchase.

PLATFORM BETWEEN PADDLE AND CASES.—To be same length as paddle-cases, made water-tight same as in the *New Grenada*, gangway planks to communicate with round-house aft, and top-gallant forecastle forward, made substantial as is general in cattle vessels.

OP-GALLANT FORECASTLE.—About 15 ft. long.

DECK-HOUSES.—Two, one in front of each paddle-case, 12 ft. in length, framed with oak and sheathed with yellow pine, one to be fitted with sleeping berths, and the other with store rooms and deck water-closett.

WATER TANKS.—Two of wrought iron to hold 1,000 gallons each, one in fore and one in after hold, with proper air pipes and pumps.

BILGE PUMPS.—One fitted, with hand gearing complete, to each division of vessel, not less than 5 in. diameter.

SCUPPERS.—Of lead, fixed to the sides of chain and 'tween decks, where considered necessary.

QUARTER-BOATS.—Two of suitable size, at least 20 ft., with wrought iron davits, blocks, &c., complete.

COOK'S-HOUSE.—To be made of sheet iron, placed on deck near the chimney with suitable cooking range and apparatus.

WINCHES.—Two deck winches complete, capable of lifting 2 tons each.

SIDE LADDERS.—One to each side of vessel, capable of being let down with strong iron hinges and crane, man rope, and other necessaries.

BINNACLE.—To be made of mahogany, neat pattern, with compass, and additional compass in captain's room, or on platform, and both faithfully adjusted.

CAT HEADS.—Chocks and fenders, rubbing pieces of iron, scuttle chain, lockers, &c., complete.

FORECASTLE.—To be fitted up in a complete manner for the crew.

ANCHORS AND CABLES.—Number and size to be in accordance with Lloyd's regulations.

MASTS AND SPARS.—To have 3 masts of good material, and proportionate size to vessel.

SAILS AND RIGGING.—One complete suit of sails, with sail covers, tarpaulins, and boat covers, all standing and running rigging of best Petersburg hemp, chains, stays, blocks, &c., suitable to the size of the vessel, warping hawser of 6 in. rope.

WHEEL.—Mahogany steering wheel complete, brass mounted.

ENGINES.—Two steeple engines, cylinders 60 in. diameter, $4\frac{1}{2}$ ft. stroke, to be fitted with expansion valves on the best principle, air pumps to be chambered with brass, air pump rods covered with brass, full-sized bilge and feed pumps, with brass plungers, one of each to each engine, the whole to be of strength to carry 20lb. steam per square inch over the pressure of the atmosphere, and to be finished in a manner equal to that of the first-rate engine makers, with wrought iron framing, and adopting wrought iron wherever it is preferable.

BOILERS.—To be tubular, with 4 in. tubes, at least 9 ft. long, to be of strength to support 20lb. per square inch pressure of steam, capable of supplying steam, at from 12 to 15lb. per square inch pressure at full stroke and speed.

COAL BOXES.—To contain 70 tons of coals.

STEAM, FEED, AND OTHER PIPES.—To be of copper.

PAINTING, &C.—To have 2 coats of red lead inside, and 3 coaf [illegible] paint outside. All plumbers' and glaziers' work to be done in best manner.

DRAFT AND PLANS.—Of the ship engines and boilers to be submitted to the owners for approval before the work is proceeded with, and the work to be executed to the entire satisfaction of any person the owners may choose to appoint during its progress.

IN CONCLUSION.—All materials are to be of the best description and workmanship, and it is understood that without regard to any omission in the specification, the ship, with exception of state cabin fittings is to be in every respect finished in the best manner, ready for sea, and fully found in all necessary articles to fit the vessel for sea, and that the builders agree to bind themselves to the completion in 9 months from date of contract, under a penalty of £5 sterling per day for overtime.

ROYAL STEAM NAVY.

PROMOTIONS, APPOINTMENTS, &c.

Second Class Chief Engineers.—G. A. TUCK, and J. ANDERSON, to the reserve steam squadron at Devonport. A. LEYS, to the *Arrogant.*

First Class Assistant Engineer.—THOMAS BORROWMAN to the *Arrogant.*

Second Class Assistant Engineer.—J. A. BURTON, to the *Excellent.*

We are glad to perceive that the official *Navy List* has published at last, the names of the following Chief Engineers, with their respective vessels, These cannot be all that are engaged in the Navy, as we find the names of 38 only out of 87 commissioned vessels, carrying a Chief or Acting Chief Engineer.

Name.	Vessel.	When Appointed.	Station or Port.	h. p
Aitchison, Geo.	Trident	16 May, 1848	Part. Service	350
Bain, Thomas	*Virago*		Devonport	300
*Baker, Thomas	Vic. & Albert	8 August 1848	Portsmouth	430
Barber, Jabez	Sharpshooter	11 April, 1848	Mediterranean	202
Bardin, G. G. (act) ...	Hydra	3 April, 1848	S. E. C. Am.	220
Bell, John (act)	*Volcano*		Malta	140
Boswell, John	*Simoom* (b)		Glasgow	350
Brown, James	Vixen	24 Oct. 1847	W. Indies	280
Brown, Thomas	*Bee* (tender)		Portsmouth	10
Bullions, Thomas......	*Greenock* (b)		Glasgow	540
Burt, George M	*Devastation*		Portsmouth	400
Casey, Edward				
Chase, Joshua	Rattler	13 Feb. 1849	C. of Africa	200
Chester, John				
Chillcott, William ...	Cyclops	5 Oct. 1848	C. of Africa	320
Closh, John R..........	*Encounter*		Portsmouth	360
Cooke, Richard	*Termagant*		Portsmouth	620
Davey, John	*Hogue*		Sheerness	450
*Dinnen, John	Fisgard	21 Dec. 1848	Woolwich	
Dinnen, Wm. A.......	Shearwater	17 Mar. 1848	Part. Service	160
Downie, John (act)...	Undine	1 Dec. 1847	Dover	110
Dunkin, William ...	*Ajax*		Portsmouth	450
Eames, William	Driver	18 Sept. 1848	Pacific	280
Elcock, Geo. (act) ...	*Amphion*		Sheerness	300
Eyers, James (act)...	Harpy	4 Sept. 1847	S. E. C. Am.	200
Fothergill, Robert ...	Cherokee	10 Jan. 1848	L. of Canada	200
Gow, Robert	*Hecla*		Sheerness	240
Harris, Sampson	*Styx*		Deptford	280
Hetherington, Jno ...	*Jackal*		Devonport	150
Hoare, Benjamin......	*Vesuvius*		Woolwich	280
Hobbs, Charles	*Birkenhead*		Portsmouth	556
Jago, Robert (act) ...	*Sampson*		Woolwich	467
Jeffery, William	*Phœnix*		Portsmouth	260
Johnson, Maurice ...	*Firebrand*		Woolwich	410
Kaye, George G.......	Stromboli	23 Dec. 1847	Part. Service	280
Keeton, George	Firefly	13 Jan. 1848	W. C. of Af.	220
Lambert, John	*Archer*		Woolwich	202
Langlands, Alex	*Dauntless*		Portsmouth	580
Langley, John H. ...	Dragon	23 June, 1847	Ireland	560
Leys, Alexander	Arrogant	14 Mar. 1849	Portsmouth	360
M'Innes, A. (act) ...	Bulldog	4 Sept. 1847	Mediterranean	500
Meredith, S. B.	Cuckoo	15 Sept. 1848	Channel Is.	100
Minninnick, W. B....	Blazer	23 Oct. 1847	W. C. of Af.	136
Mitchell, Alexander	*Growler*		Devonport	280
Morris, William				
Murdock, G. (act) ...	Penelope	21 July, 1847	W. C. of Af.	650
Neill, Joseph	Geyser	21 July, 1847	Cape of G. H.	280
Nickoll, Robert	Antelope	4 Sept. 1847	Mediterranean	280
Parry, Samuel.........	Pluto	3 Mar. 1848	W. C. of Af.	100
Partridge, D. (act) ...	*Gladiator*		Woolwich	430
Payne, James	Black Eagle	21 Jan. 1848	Woolwich	260
Pearce, Francis	*Basilisk*		Woolwich	400
Pemberton, C	Medea	21 July, 1847	China	350
Pemberton, S..........	*Sphynx*		Portsmouth	500
Phillips, J. J. (act)...	Oberon	8 Oct. 1848	Mediterranean	260
Pook, William J. ...	*Myrmidon*		Woolwich	150
Price, William	Odin	21 July, 1847	Mediterranean	560
Ramsay, Thomas......	*Vulcan*		Woolwich	350
Renwick, C. H.	Triton	25 Mar. 1848	Mediterranean	260
Richardson, Wm. ...	*Spiteful*		Devonport	280
Rundle, James P. ...	Terrible	21 July, 1847	Mediterranean	800
Rundle, William......	Fury	21 July, 1847	China	515
Russell, George	Rosamond	4 Sept. 1847	Mediterranean	287
Snell, John	*Minos*		Lake Erie	90
Steil, James	*Retribution*		Portsmouth	800
Taylor, Robert	Centaur	26Jan. 1849	W. C. of Af.	540
Templeton, William	*Conflict*		Devonport	400
Thaw, John	*Hecate*		Portsmouth	240
Thompson, Henry ...	Acheron	30 Nov. 1847	N. Zealand	160
Truscott, Thomas ...	Vic. & Albert	4 Jan. 1848.	Portsmouth	430
Tucker George, (act)	Inflexible	4 Sept. 1848	East Indies	378
Urquhart, James......	*Niger*		Woolwich	400
Vedder, John	*Salamander*		Devonport	220
Vickers, John	Vic. & Albert	1 Jan. 1848	Portsmouth	430
Ward John	*Sidon*		Portsmouth	560
Weeks, George	Gorgon	11 April 1848	Pacific	320
Whyhan, James	Blenheim	25 Jan. 1848	Portsmouth	450
Wratten, W. G. (act)	Spitfire	21 April 1848	Mediterranean	140

NOTE—Those marked * are Inspectors of Machinery afloat. The ships' names in Italics are those not in commission.

LAUNCHES, DOCKYARD INTELLIGENCE, &c.

LAUNCH OF THE ARCHER, STEAM-VESSEL.—This vessel was launched at Deptford Dockyard on Tuesday, March 27. She was laid down on the 18th of October, 1847, and has been built under the superintendence of Mr. Wilcox, master shipwright, from a plan by Captain Lord John Hay, C.B., one of the Lords of the Admiralty. It was originally intended that she should have engines of 250 horse-power, but subsequent experiments having shown, that vessels fitted with screw propellers have attained a greater proportionate speed with engines of less power, she is to be fitted with those lately taken out of the *Rifleman*, of 202 horse-power. This change gives her a greater space in the hold by 18 feet, and the less weight will also enable her to carry a greater armament, and instead of one 68-pounder of 95 cwt. and 10 feet long, one 10-inch gun, 85 cwt. 9 feet 4 inches long, and two 32-pounder guns of 25 cwt., 6 feet long; she is to mount two 68-pounders of 87 cwt., and twelve 32-pounders of 42 cwt., and it is said she may be used as a troop-ship, having every convenience for the accommodation of 400 troops, in addition to her crew. Her intended engines are to be fitted to the *Horatio*, steam-guard ship, at Chatham. The preparations for the launch having been completed at a quarter past three o'clock, and a bottle of wine having been opened, Mrs. Sidney, wife of Mr. Alderman Sidney, drank success to the *Archer*, and then broke the bottle on the bows of the vessel. In a few minutes after the *Archer* glided into the water, cheered by the assembled spectators. The *Monkey* then towed her to Woolwich to have her engines fitted. The following are the dimensions of the *Archer*:—

	Ft.	In.
Length between perpendiculars . .	187	4½
Length of keel for tonnage . . .	162	7¾
Breadth extreme	33	10½
Breadth for tonnage	36	6½
Breadth moulded	32	10½
Depth in hold	18	11
Burden in tons, old	973	22-94
Burden in tons, new	706	69

LAUNCH OF THE BUZZARD.—This steam-sloop has been launched at Pembroke Dockyard. The following are her principal dimensions, as well as those of the *Magicienne*, lately launched:—

	Magicienne. Ft.	In.	*Buzzard.* Ft.	In.
Length between perpendiculars .	210	0	185	0
Length of keel for tonnage .	185	6	162	0
Breadth, extreme . . .	36	0	34	0
Breadth, for tonnage . .	35	8	33	8
Breadth, moulded . . .	35	0	33	0
Depth in hold . . .	24	6	20	0
	Tons.		Tons.	
Burthen in tons . . .	1,255		997	

HARWICH PACKETS.—The company which, it was stated in our last, had purchased the old Holyhead Packets for the purpose of runnin gthem between Harwich and Holland, has, it appears, not been able to raise the requisite purchase money. The vessels are, consequently, returned to the dockyard authorities.

CAPTAIN BULLOCK'S RAFT.—Captain Bullock has had his new raft tried on board the *Widgeon* steamer at Woolwich. The invention is of the simplest description, consisting of four pieces of timber held together in the form of a square by swivel bolts, and supported on knee bolts attached to the inside of each of the paddle-boxes at the same elevation above the deck as the present pilot platforms are placed. The dimensions of the square platform adopted by Captain Bullock and placed on the *Widgeon* are 18 feet 6 inches by 16 feet 6 inches, having a railing of chains along the whole of the inside of the square, and a cross plank placed length-ways with the line of the vessel, on which a boat is supported, and her keel so placed in an opening that, however crowded she might be with persons during a shipwreck, or the sinking of a vessel from any cause, the boat could not be upset. Six seven-gallon casks were attached under the platform, and placed

in the basin, and 15 men went into the captain's small boat, which is a "dingy" capable of holding three people, and the buoyancy of the raft was so great that the boat was only immersed four inches and a half, and the platform about an inch in the water. After the experiments had taken place, the raft was hoisted on board the *Widgeon* by four men. Captain Bullock intends having the platform lined underneath with cork, which will give it a greater degree of buoyancy, and render it capable of supporting a great number of persons. He also proposes having casks half-filled with fresh water as a means of support, which would be found of great advantage in cases of shipwreck, and a netting thrown across the inside of the square of the raft would support a large quantity of provisions. The swivel bolts for joining the four corners and the cross plank for supporting the boat are so constructed that the square frame may be made into a diamond shape and steered towards any particular point, and by the aid of a temporary sail raised on a spar, a great distance on the ocean might be traversed with safety, as there would be no greater danger than the injury arising from being wet on the boat filling with water. The plan is so simple and easy of construction, and of being taken to pieces and put together on the shortest notice, that it may be made available in every description of sailing vessels.

INCRUSTATION IN BOILERS AT WOOLWICH DOCKYARD.—We learn from the Woolwich papers that experiments are at present taking place at the steam factory works, at Woolwich Dockyard, to test the efficiency of the plans of Mr. Robt. Armstrong, C. E., the inventor of a new Boiler Cleansing Machine. The boilers at the factory are supplied with water from a well, which deposits on evaporation, a large quantity of the carbonate, as well as a portion of the *sulphate* of lime. The quantity of incrustation has been so great as to become upwards of the eighth of an inch in three weeks, causing an extra consumption of coals, and requiring such a degree of heat as to injure them to a considerable extent. Mr. Armstrong's plan is to place several ox-feet in perforated iron baskets, and suspending them in the boiling water. The jelly extracted from the feet, keeps the material of incrustation in a state of suspension until it enters a collecting apparatus, which is stirred by a revolving handle when it is intended to discharge the thick accumulation into a trough at a distance from the boiler.

[Mr. Armstrong's method of making animal jelly a preventive of *sulphate* of lime incrustation in preference to using sal-ammonia or other corrosive chemical substances, is probably not unknown to our engineering readers who are acquainted with his work on boilers, which contains the following practical reason that led to its adoption, namely, "that the ordinary culinary boilers used for cooking meat and vegetables never fur up, while the tea kettle which is used for boiling spring water alone, uniformly does so." p. 225.]—ED. ARTIZAN.

STEAM NAVIGATION.

LOSS OF THE STEAM-SHIP FORTH.—An investigation into the circumstances attending the loss of the steam-ship *Forth*, on the Alacranes reefs, was held at Southampton on the 1st inst. The tribunal was composed of the following gentlemen, who constituted an inquiry committee of the company:—Captain Shepherd, of the East India Company, an Elder Brother of Trinity-house, Chairman; Captain Mangles, a managing director, Vice-Chairman; Captain Nelson, an Elder Brother of Trinity-house, Captain Barton, R.N., the company's superintendent at Southampton; Captain E. N. Chappell, R.N., secretary of the company; Captain Wish, R.N., auditor of the company; likewise the commanders of three of the company's ships in port, Lieut. P. Hast, R.N., of the Avon (the senior officer and commodore of the company's fleet), Captain William Allan of the Dee; and Captain W. Vincent of the Severn. The whole tenour of the evidence (to which a patient and careful hearing of four hours was given by the committee) demonstrated that the loss of this fine steamer arose from—1, an error in the reckoning; which however, ought to have been counteracted by different observations and attention to the sounding lead; 2, a violation of the company's regulations in regard to frequent soundings, as before alluded to; and, 3, by the taking from his post one of the look-out men. As the most explicit instructions on these heads are laid down in the company's volume of regulations published for the information and guidance of their officers, the resolution arrived at, after deliberation, was, that a laxity of discipline in relation to the duties of the navigation of the ship, caused her position to be wrongly computed, and her total destruction consequently followed. The decision arrived at by the committee was—that it would be their painful duty to recommend to the Court of Directors the dismissal of Captain Sturdee and the chief-officer from the company's service; that the second officer should be reduced to the grade of third officer for one voyage, and that the third officer should be reduced to the grade of fourth officer for one year.

LAUNCH OF THE JUPITER, STEAM-VESSEL.—Mr. Dobson and a large party of directors of the Gravesend Star Company, Captain Hafiz Bey, of the Egyptian frigate; Mr. Humphries, Chief Engineer at Woolwich Dockyard; Mr. Landseer, brother of the celebrated painter; Mr. Brockedon, Mr. Redman, and a number of ladies and gentlemen, assembled at Messrs. Miller and Ravenhill's establishment at Blackwall on Saturday March 24, to witness the launch of a fine iron steamer, built by the firm for the Star Company. This vessel is 165 feet in length between perpendiculars by 18 feet broad, with a depth of hold of nine feet six inches, and of 248 48·94 tons burden, from a design by Mr. Pasco, who also designed the *Llewellyn* Holyhead mail-packet, the *Ondine* mail-packet, the *Meteor*, and *New Star* London and Gravesend steamers. The engines of the *Jupiter* are two of 40 horse-power each, on the oscillating principle, having tubular boilers and brass tubes, with feathering paddle-wheels. The interior of the best cabin is fitting up with good taste, the doors and partitions being formed of mahogany, with bird's-eye maple panels. At 2 o'clock, p.m. a signal was given that all the preparations for the launch were completed, and Miss Beckett, daughter of the senior director of the Star Company, having broken a bottle of wine on the bows, at the same time naming the vessel, she immediately after glided into the water, cheered by the spectators on shore and on board. The *Jupiter* is now in the East India Docks, receiving her machinery, and we must say, is one of the most elegant models we have ever seen.

NORTHFLEET.—Great preparations are being made in Mr. Pitcher's newly enlarged dockyard, for, it is said, the laying down of three steamers of 1,600 tons, and six others of smaller dimensions; three of them for the West India Packet Company's service. Mr. Pitcher has built several of that company's steam ships, and has a general contract for their repairs.

LIGHTHOUSE ON COHASSET ROCKS, U.S.—From the official report of Captain Swift, under whose direction this lighthouse is being constructed for the American Topographical Bureau, we learn that the form of the lighthouse frame is an octagon, of 25 feet diameter at the base; the structure is formed of eight heavy wrought iron piles, or shafts, placed at equal distance from each other, with one also at the centre. The piles were forged in two pieces each, and are connected together by very stout cast iron or gun-metal sockets, the interior of which is bored, and the pile ends are turned, and secured to the sockets by means of large steel keys, passing through the piles and sockets. Above and below the joints or sockets, and connecting the middle pile with each outer pile, there extends a series of wrought iron braces, and the outer shafts are connected together by similar braces, extending from one to the other, and thus the whole structure is tied together. The drilling of the holes for the lighthouse occupied the better part of two seasons. The erection of the iron structure in place, it may be conceived, was comparatively a work of much less difficulty, and with favourable weather, an undertaking not requiring much time. The triangle and drilling machine was swept from the rock twice during the first season's operations, and the men were frequently washed from the rock, but happily no lives have been lost. The holes were finished on the 16th August—that is to say, nine holes of 12 inches diameter and 5 feet deep. The entire height of the structure from the surface of the rock to the top of the lantern will be about 70 feet, and upwards of 50 above the line of the highest water. The entire weight of the iron work is about 70 tons.

IRON STEAMERS OF WAR.

TO THE EDITOR OF THE TIMES.

SIR,

Having had the honour to construct the first iron steam-frigate for Her Majesty's service, and her name having been prominently brought before the public in the discussions that have lately taken place as to the state and efficiency of Her Majesty's steam marine, I beg that you will permit me, in consideration of the importance of the subject, and in justice to myself, as the contractor for the Birkenhead, and to the late Board of Admiralty, who ordered her, to state a few facts relative to the introduction of iron as a material for constructing steam-vessels for Her Majesty's service, and proofs of its adaptation to that purpose. I have been engaged in the construction of iron vessels since 1829, and from that time until 1839, had constructed about 20 vessels of that material; among them were those forming the Euphrates expedition, and several vessels for North and South America, the East Indies, Africa, and the Irish inland and coasting trades.

From the favourable reports received of the durability, strength, and performance of these vessels, employed as they were in the four quarters of the globe, the Admiralty were induced to favour me with an order to construct a packet for the Dover station, to be brought into competition with a wooden vessel of the same class and power. The annexed abstract, compiled from a return in the naval estimate report of last year, shows that the result of that comparison was not unfavourable to iron as a material for packet steamers:—

STATEMENT OF FIRST COST AND WORKING EXPENSES OF HER MAJESTY'S PACKETS WIDGEON AND DOVER.

	Widgeon Wood		Dover Iron
Tonnage, O.M.	164	—	224
Power of engines (horse-power)	90	—	90
Number of years at work	10½	—	7½
First cost	£10,121	—	£10,153
Total cost of repairs of hull	1,844	—	630
Average repairs of hull per annum	175	—	84
Total cost of repairs of machinery	5,176	—	1,565
Average cost of repairs of ditto per annum ...	493	—	209
Total cost of repairs of hull and machinery ...	7,020	—	2,195
Average cost of repairs of hull and machinery per annum	668	—	293

In 1839 the Secret Committee of the Hon. Court of Directors of the East India Company instrusted to me the construction of several iron steam-vessels, suitable for river and sea service, and capable of carrying guns; amongst these were the *Nemesis* and *Phlegethon*, armed with 32-pounders, the one of 700 and the other of 550 tons burden. The history of the operations on the coast of China, from the forcing of the inner passage to Canton to the conclusion of the war in the Yang Tse Kang, shows that these vessels under their gallant commanders were distinguished for performing services which no wooden vessel could have accomplished, and, as far as warfare in Chinese waters can demonstrate, proved themselves equal, at the least, to any other steamers then employed in those seas; while the accounts received by every mail from China of their continued employment against pirates and in other services, show that nearly 10 years' wear and tear in a tropical climate has not affected the efficiency of the hulls, armament, or machinery.

The services of these steamers (the first iron vessels that had been armed with heavy guns) induced the agents of the Mexican Government to order the steam-frigate *Guadaloupe*, of 800 tons and 180 horse power, armed with two 68-pounder pivot, and four 24-pounder broadside guns.

The same reasons induced the Admiralty to depute a gentleman of well-known scientific attainments, one of the late School of Naval Architecture at that time holding a situation in Woolwich dockyard, to investigate and report upon the construction of the *Guadaloupe*, and the applicability of iron as a material for steam-vessels of war. Mr. Large spent several weeks at Birkenhead making detailed drawings of the different parts of the vessel, and experiments on the material.

On the successful trial of the *Guadaloupe*, I was called upon by the Admiralty to supply plans and a tender for the construction of a steam-frigate of the first class; and, to guide me in designing her, I applied for, and was furnished with, the following statement of the weights she would have to carry, viz. :—

	Tons.	Cwt.
Masts, yards, rigging, sails, cables, anchors, and stores	99	12
Water, provisions, crew and effects	86	18
Guns, powder, and shot...	59	4
Coals for 12 days	420	0
Engines (378 horse-power)	342	0
	1,007	14
Estimated hull for an oak ship	750	0
Displacement required for the oak ship, at 15.6 mean draught	1,757	14

The designs I submitted, and which were finally approved, were for a vessel 210 feet long (being about twenty feet longer than any vessel of her class had been built) and 37.6 beam, with a displacement of 1,918 tons on the load water-line of 15.9. The only change made by the authorities at the Admiralty in these designs was in the position of the paddle-shaft, which they ordered to be moved several feet more forward; the change was unfortunate, as it makes the vessel (unless due care is taken in stowing the hold) trim by the head. With this exception, I am answerable for the model, specification, displacement, and general arrangement of the hull of the vessel. The *Birkenhead* was launched in 1845; her hull was at that time complete, with the exception of some cabin fittings, estimated at 15 tons. Her launching draught was 9 feet 9 inches, showing the weight of the hull to be 903 tons; leaving for the machinery, stores, &c., given to me at 1,007 tons 14 cwt., 1,000 tons. If these weights had not been exceeded, the vessel would have gone to sea within one inch of her calculated draught—say, 15 feet 9 inches.

The *Birkenhead* was never tried as a frigate. Before she was commissioned it was taken for granted that iron frigates would not answer, and her destiny was altered to a troop-ship, a poop added to her, and she is loaded with coals and stores generally to two feet beyond her intended load-water line. With all these disadvantages, I am informed by those who have sailed in her that she is a fast and remarkably easy vessel, and I have no hesitation in saying that, if loaded only with the weights for which I was directed to construct her, she will not be excelled in speed and sea-going qualities by any steamer, private or public, of her size and power.

From the foregoing statement it is evident,—

That the Admiralty did not adopt iron in the construction of steam-vessels, even as packets, without due inquiry and investigation. That they waited until the East India Company and foreign Governments had made the experiment of what iron vessels-of-war would do before ordering any for their service.

That the vessel built was capable of carrying on her estimated load water-line of 15.9 the weights she was designed for.

That the efficiency of the *Birkenhead* as a steam-frigate has never been tested by an actual trial; and that in all cases where iron vessels have been tried in warfare they have answered admirably.

Apologizing for the length of this letter,

I am your obedient servant,

Birkenhead, April 12. JOHN LAIRD.

PROGRESS OF LITERARY AND SCIENTIFIC INSTITUTIONS.—A return obtained by Mr. Scholefield, M.P., shows that applications have been received since May, 1844, from upwards of 100 literary and scientific societies, or institutions, for certificates of exemption from local rates. It has been decided that when the rooms of an institution are let out for profit for purposes foreign to the real objects of the society, such as political meetings and the like, the exemption from rates does not hold good.

ON STOVES AND FIRE-PLACES.

(Continued from page 95.)

THE PORTABLE POISON STOVE.—Since we penned our last remarks on this subject, an awful accident has occurred at St. John's-wood, resulting in the deaths by suffocation, of three young women, servants at a school. It appears from the evidence given at the inquest, that the room in which they slept was not their ordinary sleeping-room, but a small one not usually occupied, and without a fire-place. One of them being unwell, obtained permission to sleep in the room, and subsequently, three of the other servants joined her, taking with them a small portable stove, which usually stood in the hall, to warm the room. In the morning, when the servants were called, three were found dead, and, in the fourth, the spark of life was all but extinct; as it was, she just recovered sufficiently to give evidence before the coroner.

The principal of the school stated, that she had bought the stove, with the clear understanding that, so long as *prepared* charcoal, sold by the stove maker, and for which a high price was charged, was burnt in it, no ill consequences could ensue. The jury, after deliberating for an hour, returned the following verdict:—"That Elizabeth Pritchett, Eliza Griffiths, and Frances Carter, were found dead in a small and ill-ventilated room, and that their deaths were caused by the poisonous fumes of burning charcoal, which had been sold at an extravagant price, under the fraudulent name of 'prepared fuel;' and that these attempts to vend charcoal under the name of prepared fuel, to be used in Carman's, or any other such portable stove, is a scandalous imposition upon the public."

Mr. Carman writes to the *Times*, complaining that his "character as a tradesman, has been brought in a most disadvantageous light before the public," and states, "When I sold the stove in question to Mr. Buckingham, he had express notice that it was adapted for the warming of a hall, for which purpose *only he said it was required*, and as such, entirely unsuitable for a bed-room. Whether Mr. Buckingham delivered these instructions or not to Miss Mann, I cannot say." Now, setting aside what seems an evident quibble about Mr. Buckingham saying "it was for a hall only," or "only saying it was for a hall," and "as such, entirely unsuitable for a bed-room;" for, on the latter point, it does not appear that Mr. Buckingham expressed an opinion, there is, unfortunately for Mr. Carman, ample evidence in the other direction. Mr. Cook states, "I beg to recall to his recollection, the evidence which was given by me to the jury at the Eyre Arms—that I there proved having been at his shop with a friend, who purchased one of his stoves, and a sack of the prepared fuel, *with the clear understanding that it was to be used in a small library without a chimney.* The question was asked by me, whether the fuel was charcoal. The answer was a decided negative; and on inquiring further, whether any harm could arise from it, I was assured that it was perfectly harmless (!) * * * The printed papers which were circulated, recommending its sale, stated that it might be used in the library, harness-room, and other places, and not confined to the hall and passages, as he now alleges."

Those of our readers who have seen these stoves, which in principle and deadly effect are the "Joyce's Stoves," which were announced a few years back, as the discovery of the age, will easily understand what a dangerous character the very portability of these stoves confers upon them. English people have but little idea of warming their bed-rooms, although the sitting-rooms are generally kept at fever heat, but when an unusually cold night suggests the idea, "how comfortable it would be to have a fire in one's bed-room," nothing offers so little trouble as the neat stove, which has been used in the hall so long that all the verbal cautions and qualifications included in its price are forgotten. The stove is sent up, perhaps half an hour before bed-time, just long enough to draw the damp out of the walls—the room feels chilly, on entering it—the door is shut—"It will go out of itself, and I am not afraid of fire."—We see a coroner's inquest on the unhappy victim in the paper a few days after, but it is nobody's business to interfere, and we turn over to a more interesting column and read of the indefatigable exertions of the detective police to discover the weapons with which some notorious assassin has committed his crime. There is a subterraneous cave near Naples always half full of foul air, in which the guides immerse dogs to show its effect in destroying life, for the gratification of the visitor. How much longer will public opinion permit similar experiments to be tried on the human species in England?

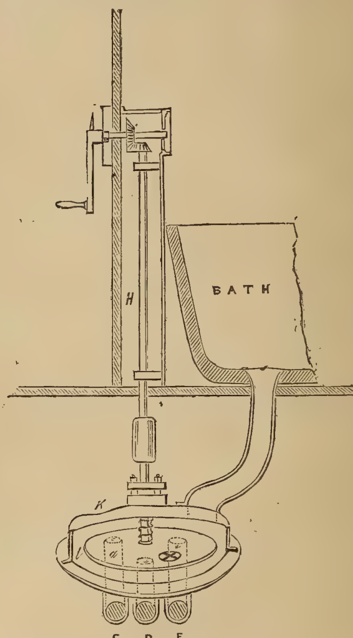
VALVES AND COCKS FOR BATHS AND WASHHOUSES.

SIR,—It will be conceded to me that public institutions, of such value and importance as "Bath and Washhouses," should be most efficiently fitted, and by the least possible expensive means. The costly, and in several instances, impracticable way in which this has been done as in Trafalgar Square, had led to some rather curious occurrences, and certainly bears evidence of a very small amount of practical knowledge on the part of the architect or civil engineer.

Mather's registered threee way valves, a sketch and description of which I insert, Fig. 1, are those used for letting the water on and off at the Baths.

MATHER'S VALVE.

FIG. 1.



Any practical mechanic, when he is informed that these valves are constructed on the old principle of one flat plate moving centrically on another, knows that they never wear tight, particularly as the pressure of water has a tendency to separate the plates. If the pressure were applied to force the plates together, and they were set eccentrically, the top one to the seat, they might act better; but as they are, experience, the infallible test, has already demonstrated their want of the wear and tear quality, so essentially requisite to the efficient working of a Public Institution, appropriated to the constant use of the multitude.

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a, revolving plate, having one passage through it; *b*, faced seat, having three passages leading from the three pipes, C, D, E, being hot, cold, and waste water-pipes. When the passage X, in the plate *a*, is turned by spindle H, so as to stand over *c*, hot water flows through it, and passes into the bath; the same operation takes place, if the passage is turned over the cold water passage *d*, or waste *e*; space enough is left between the passages, to allow the hole in the plate *a*, to be covered by the faced seat; K, casing to which the pipe to the bath is attached, and which covers in the valve and *a*, and fastened to the seat *b*.

(To be continued.)

ANALYSIS OF PATENTS.

Alexander Parkes, of Birmingham, experimental chemist, *for improvements in the manufacture of metals, and in coating metals.* Patent dated 27th April, 1848.

This invention relates to the separating copper and some other metals from their sulphuretted ores into the state of regulus, or coarse metal, by the use of sulphates of lime, soda, potash, or barytes. The patentee also describes a method of employing hot or cold blast to decompose the sulphurets of copper and other metals. The improvements in coating iron and steel consist in using a compound of lead, tin, and antimony, kept fused under a thick coating of chloride of barium and sodium. Into this alloy the articles, after being carefully cleaned, are to be dipped until they are sufficiently coated.

Thomas Restall, of Tooting, Surrey, watchmaker, and Richard Clark, of the Strand, Westminster, lamp manufacturer, *for improvements in chronometers, clocks, watches, and other timekeepers.* Patent dated 11th May, 1848.

The first part of this invention relates to the escapement of time-pieces, and is intended to supersede the ordinary escapement; but, as the superiority of ths arrangement is not very evident, we shall not attempt to describe it. The second part has relation to the pendulums of clocks, composed of two metals of unequal expansion, and also to a method of applying the compensation to the spring of the balance wheel, and not to the balance wheel itself. The third part relates to a method of attaching musical box work to the mechanism of clocks, so as to obviate the necessity of winding up the musical mechanism.

James Parker Penny, of Clarendon-terrace, Notting Hill, Middlesex, gentleman, *for certain improvements in obtaining copper from copper ores.* Patent dated 26th May, 1848.

The patentee proposes to smelt the carbonates and oxides of copper, by such means as to obviate the use of the fluxes generally employed for that purpose. This is effected by adding to the fused copper, a quantity of chips of wood, or other carbonaceous matter, which, when intimately mixed with the ore, will, by its combustion, produce the desired effect.

Felix Hyacinth Folliet Louis, of Southwark, Surrey, gentleman, *for an improved method or process of preserving certain animal products.* Patent dated May 26, 1848.

This invention relates to a method of converting milk into a solid substance, soluble in warm water, and capable of preserving its sweetness for a long period. About 4 oz. of sugar is to be added to every gallon of milk, which is then to be evaporated either in open pans by the atmosphere or artificial heat, or by the action of an apparatus consisting of a series of steam evaporating pans, placed above one another, a rotating shaft with stirrers passing up through them all. By the combined action of the heat and the stirrers, the milk will be reduced to a pasty substance, which is to be compressed into suitable moulds. The milk or cream may also be treated by first separating the curd from the whey, and reducing the curd to a solid state.

William Wood, of Cranmer-place, Waterloo-road, Surrey, carpet manufacturer, *for improvements in weaving carpets, and in printing carpets and other fabrics.* Patent dated 30th May, 1848.

The first of these improvements consists in the addition of a thickening to the carpet, known as "the dead," for the purpose of rendering it more soft and elastic. The second improvement consists in a mode of printing patterns upon the surfaces of piled carpets, or other fabrics, by allowing the printing surfaces to pass over and impress upon the surface of the fabric several times, so as to ensure the pattern being perfectly printed.

Henry Adcock, of Moorgate Street, in the City of London, civil engineer, *for certain improvements in furnaces and fire-places.*

The object of the first part of this patent is to prevent the introduction of cold atmospheric air into the furnace. This is effected by dispensing with the ordinary fire bars, and using instead, a kind of hoppers, to be charged alternately with coal, the air passing only through the fresh supply of fuel. In reverberating furnaces the patentee proposes to form the arch double, with a stratum of air between, to prevent the escape of the heat. A method is also described of forming the fire-box of a locomotive, in such a way that the fuel passes through a shoot, passing down to the fire-bars, and surrounded with a water space.

Mathew Hague, of Waterhead Mills, Oldham, Lancashire, machine maker, and Joseph Firth, of Huddersfield, Yorkshire, cotton doubler, *for certain improvements in machinery for twisting and doubling cotton yarns, and other fibrous materials.* Patent dated 26th May, 1848.

This specification, like most of its class, would require several drawings to explain its details; we must therefore, content ourselves with giving the claims, which are as follows:—Firstly. The rotation of the first motion shaft being uniformly in the same direction, by which any back lash or shock to the working part of the machine is avoided. Secondly, In effecting the "running out" of the carriage by means of the scroll-wheel and bands, dispensing altogether with the racks ordinarily made use of. Thirdly. In affecting the "putting up" of the carriage by reversing the motion of the scroll-wheel and bands by which the running out was performed. Fourthly. The methods of working the "faller movement," as described. Fifthly. The method of "winding on" at the variable speed required, by means of the leather friction cone and the action of the lever upon the rim pullies and endless bands, as illustrated and described. Sixthly. The method of effecting the "cop-motion," as described. Seventhly. The systematic action of the mechanical arrangements, or any modified system of mechanical equivalents, calculated to render the machine self-acting, or capable of performing the various operations required, independent of the application of manual power, as described.

Richard Christopher Mansell, of Grange-road, in the county of Surrey, gentleman, *for certain improvements in the construction of vehicles used on railways, or on common roads.* Patent dated 1st June, 1848.

The first of these improvements consists in applying several new forms of springs to vehicles, denominated, by the patentee, elongating springs. These springs are of an elliptical shape, attached at their ends only, without any central bearing, in such a manner that the strain upon them tends to elongate them, whence their title. The second part consists in the application of these springs to buffer and drawing springs. The third part consists in constructing wheels, in which the tyre is fixed cold. The arms of the wheel are to be screwed at the ends, right and left-handed, screwed into the boss, at one end, and into blocks or shoes at the other; a wooden rim is fitted round these shoes, and the ordinary tyre over the wood. The arms then, being screwed up, will hold all the parts of the wheel in close contact. Each side of the tyre is to have a groove turned in it, and a ring with a corresponding tongue is bolted on, on each side, to prevent the tyre flying off, in case of a fracture.

Benjamin Lathrop, of King-street, Cheapside, in the city of London, Esq., *for an improved wheel for railway purposes.* Patent dated June 6th, 1848.

In wheels of cast-iron it is generally usual to run a division or divisions in the centre or boss, in order to prevent them from being what is termed "iron-bound." That is, with the spokes in a state of tension, arising from the unequal contraction which takes place during the cooling of the metal. These divisions in the nave or boss are afterwards filled, and wrought-iron rings shrunk on each side, to retain the whole firmly together. Now, the object of this invention is to construct wheels of cast iron, which shall not be iron bound, and yet, at the same time be wholly of cast iron. Instead of connecting the rim or tyre to the nave by spokes, as usual, an entire disc is produced in the casting; and for an ordinary railway carriage wheel, this should be about half an inch in thickness; but in order to impart the necessary rigidity to the structure, it is deeply indented or corrugated in the plane of the wheel's motion; that is with the flutes running radially. The depth of these flutes is to the extent that the breadth of the rim will admit. The nave is made somewhat larger than usual, having an internal cavity, through which the axle passes, openings being made at each side for its reception. On a section taken round the nave, the corrugations assume a sharp angular outline, from the smallness of the diameter, while at the periphery they become much wider, presenting at the front elevation, somewhat the appearance of a fan. The disc of these wheels is also corrugated in the direction of the radii, which might more properly be said to be in waved lines; of which form various modifications are shown: some being in simple curves, similar to the ordinary method of casting the spokes of wheels, to prevent their being iron bound. In order to strengthen the disc, projections or bracket-pieces are cast in each hollow, from the inner side of the tyre, and also from the nave, proceeding radially to any required extent in the same corrugated or waved line, as the radial flutes or corrugations. In conclusion, the patentee remarks that he does not claim wheels of cast iron, in which the disc is corrugated in concentric circles only, but claims as his invention: First, wheels of cast iron of such a form that the part equivalent to the spokes of a common wheel, which he calls the disc, shall be corrugated on the plane of the wheel's motion, and at the same time in the line of the radii on a plane at right angles to such plane of motion. Secondly, the combination of the corrugated disc mentioned, with the projections above described as the second form of disc. Thirdly, the combination of a disc corrugated on radii, and in plane of wheel's motion with projections, described as the third form of disc.

Thomas Richardson, of Newcastle-upon-Tyne, chemist, *for improvements in the manufacture of manure.* Patent dated May 26, 1848.

THE patentee proposes to dissolve animal matters, such as bones, guano, &c., containing phosphate of lime, in alum liquor, by boiling them in iron pans lined with lead; the animal matters being first pulverized to assist their solution. The liquor formed is to be evaporated and dried, and may then be ground to powder, ready for use.

William Seaton, of Camden Town, Middlesex, gentleman, *for improvements in closing tubes, and in preventing and removing the incrustation in steam boilers.* Patent dated 30th May, 1848.

THE first part of this invention relates to a method of closing the ends of tubes which are used as heating surface in boilers of American design, but which it is not probable will ever find favour with English engineers, the tubes being hung over the fire, and their upper ends only being open to an upper water space, and consequently, there being no current of water through them. The patentee proposes to close the lower ends of such tubes by welding them with the aid of dies into a hemispherical form, instead of merely plugging them up as is commonly practised. The second part consists in employing certain chemical and mechanical means for preventing the incrustation of boilers. Oxalic acid, carbonate of potash, or carbonate of soda, are to be mixed with the water before it enters the boilers, and the lime being precipitated, may be removed by filtration. Muriatic, nitric, and acetic acids may be added to the water in the boiler to hold the lime in solution, which must then be removed, in the usual way, by blowing off. Sawdust and charcoal powder may also be employed to act mechanically in removing the deposit.

Jasper Wheeler Rogers, of Nottingham-street, Dublin, civil engineer, *for certain improved methods and machinery for the preparation of peat as a fuel, and in combination with certain substances as a compost or manure.* Patent dated June 1, 1848.

This invention consists of a series of processes for the purpose of cutting, drying, and compressing peat, and of charring it for certain operations, for which, from its freedom from sulphur it is particularly applicable. The system described for cutting the peat does not vary greatly from the most approved systems now in use. The peat is cut out in blocks, forming draining trenches at suitable distances and levels for draining the bog. When the suface is partially drained, the peat is removed in terraces, which expose a large surface to the atmosphere, and prevent the sides of the trenches from falling in from lateral pressure. The peat, after being cut, is placed on frames in portable roofed sheds, where it becomes still further dried. Attached to these sheds are stoves in which the peat to be charred is burnt, and the heat from these stoves is applied to dry the peat in the sheds. Machinery is described for compressing the peat, the air and moisture being withdrawn at the same time, by means of suitable pumps. The patentee also describes a method of granulating the peat to form a compost with soil or sewage matter, the object being to reduce the compost to a dry granulated, inodorous state.

James Barsham, of Stratford, in the county of Essex, manufacturer, *for improvements in the manufacture of mats.* Patent dated 1st June, 1848.

THIS invention relates to a method of making mats of a groundwork of laths, on which the cocoa-nut fibre, or other material, is wrapped, the laths being compressed in width, and firmly held in their place by grooved iron bars. The patentee claims the table machine on which the laths are compressed, and the method described of making mats generally.

William Brindley, of Birmingham, manufacturer, *for improvements in the manufacture of articles of papier maché.* Patent dated June 6, 1848.

THIS invention consists of a method of forming patterns in relief on articles of papier maché, by the use of moulds, and of using moulds formed of papier maché, properly hardened. The patentee proposes to form hollow articles of papier maché, such as hats, and wash-hand basins, the insides of the latter being lined with white lead paint, and the smell expelled by exposure to heat.

William Hunt, of Dodder-hill, Worcester, chemist, *for improved apparatus to be used in processes connected with the manufacture of certain metals and salts.* Patent dated June 13, 1848.

THE patentee proposes to construct reverberating furnaces, such as are employed in making iron, copper, salts of soda, &c., in such a manner, that small coal can be conveniently burned in them. In front of the ordinary fire-bars is a dead plate of fire-brick, on which the small coal is laid to be coked, and is then pushed forward on to the fire-bars. The only difference between this patent and the well known method of accomplishing the same end in boiler furnaces, consists in the employing a larger surface of dead plate for carbonizing the coal, in the arrangement of side fire-doors, and in the application of the principle to the peculiar kind of furnaces.

Joshua Procter Westhead, of Manchester manufacturer, *for improvements in manufacturing fur into fabrics.* Patent dated June 8, 1848.

THIS patent is null and void, the specification not having been lodged until December 13, instead of December 8. The invention consists in the weaving of the fine short fur of various animals into fabrics, in the same manner as cotton or wool.

Richard Want, and George Vernum, both of Enfield, Middlesex, *for an improved steam-engine, which may also be worked by air and other fluids.* Patent dated June 10, 1848.

THIS is a sweet scheme, truly! An *improved* oscillating engine, with its trunnions at the bottom of the cylinder, a four way cock instead of a slide, and an oscillating air pump, are the main features.

[Our correspondent, "Investigator," in our last number anticipated our verdict on this contemptible concoction of ideas.—ED. *Artizan.*]

Willliam Chamberlain, Jun., of St. Leonard's-on-the-sea, Sussex, gentleman, *for improvements in apparatus for recording votes at elections.* Patent dated June 13, 1848.

THIS invention is intended to supersede the ordinary balloting-box, and exhibits a good deal of ingenuity to effect that which can be done without any machinery at all. A counting apparatus has a number of handles attached to it, one to each candidate, and by pulling one or more of the handles, a vote is registered for the desired candidate, on a dial open to public inspection. Apparatus is added to prevent the same person from voting more than once, or as may be arranged; and the said apparatus is acted upon by the door of the apartment in which it is placed, so that when the voter leaves the room, the door in closing releases the handles, and allows the next comer to use the machine.

Charles Henry Capper, of Edgebaston, Warwick, *for a method of preparing and cleansing minerals and other substances.* Patent dated June 13, 1848.

THIS invention consists of various machines for sifting and separating ores from the earthy matters. The stuff is passed through rotating cylinders of wire gauze, of two sizes of mesh, by the operation of which the stuff will be separated into three sizes. The ore is dressed in a vertical cylindrical vessel, partly immersed in water, and to which a jigging motion is communicated. Another plan consists in having a large wheel, revolving vertically, on which the ore and water are allowed to fall from troughs. The ore is carried round by the wheel in its own direction and deposited on one side, while the earthy matters are washed, by the force of the water meeting them, over to the other side.

James Roose, of Darlaston, Stafford, tube manufacturer, and William Haden Richardson, the younger, of the same place, *for improvements in the manufacture of tubing.* Patent dated June 15, 1848.

THIS invention consists in a method of making copper or brass boiler tubes, by drawing them on a mandril, between rollers, whereby they are made without any joint, and of greater strength, the process being on the same principle as the drawing down of a short thick tube through a draw-plate, as is ordinarily practised. The tube will require annealing between the successive rollings, for which purpose the mandril is withdrawn by driving a key through it, and the socket for holding it.

John Miller, of Henrietta-street, Covent garden, gentleman, *for a new system of accelerated menaltrite locomotion, even by animal impulsion, for every species of transport machines acting by means of wheels, whether on land or water.* Patent dated June, 13, 1848. (Communication.)

THE title of this extraordinary farrago will give a fair idea of its contents. The grand idea seems to be to place the animal power in the machine itself, and allow their power of draught to be exerted on a sliding platform, to be communicated therefrom to the wheels. The axles are to be supported on friction wheels, and various system of spur-gearing are attached, by means of which the speed of the machine may be varied. A new (?) arrangement of paddle-wheel is described, called a "normal vogue paddle," in which the floats enter and leave the water in a vertical position, being acted upon by a wheel set eccentric and connected to arms on the paddle-floats.

Frederick William Mowbray, of Leicester, paper dealer, *for improvements in the manufacture of looped fabrics.* Patent dated June 27, 1848.

THESE improvements relate to the construction of the parts of the machines employed in forming the loops and manufacturing the fabric, such as the needles, the thread carriers, and the knocking off apparatus. The patentee claims the mode of manufacturing looped fabrics, by combining the frame or a bar carrying the needles, with a thread carrier, in the manner described; as also the surface for knocking over the finished work, as described.

Thomas Hunt Barber, of King-street, Cheapside, *for improvements in machinery for sawing wood.* Patent dated June 1, 1848.

THIS invention relates to improvements in sawing machinery previously patented by Junius Smith, in 1843, and consists of various methods of holding and turning the logs for cutting bevilled and crooked timbers, more particularly used in ship-building. One end of the log is supported by a roller mounted in a swinging frame, the weight of the log being counterbalanced to allow of its being shifted with ease. The timber is held by a chuck, to which a bevilling-bar is attached, by shifting which, the wood is cut at the desired bevil. A plumb-line is attached to the apparatus to indicate the bevil.

Richard Barnes, of Wigan, in the county of Lancaster, gas engineer, *for certain improved apparatus for manufacturing gas for illumination, part of which improvements is applicable to retorts for distilling pyroligneous acid, and other similar purposes.* Patent dated June 6th, 1848.

THIS is a complete gas apparatus, on the small scale. The main features are, first, a cylindrical retort of fire clay is placed vertically in a furnace, and the coals placed within it, in an iron cradle, instead of being thrown in loose, whereby the coke may be removed from the retort with great facility. A lute joint is formed of the liquid tar at the mouth of the retort, and a cap is fitted, with another water joint, by removing which the retort may be charged or the coke withdrawn. The refrigerator is of the ordinary construction, but the condenser is kept cool by the water in the gas-holder tank. The purifiers are placed within the gas-holder, by which means the gas is kept in continual contact with the lime. After the charge is exhausted, the coke is removed in the cradle, and placed within an air-tight cylinder with a cover let into a sand-joint, by the exclusion of he air from the interior of which the coke is speedily extinguished.

Joseph Foot, of Spital-square, Middlesex, silk manufacturer, *for improvements in making skeins of silk.* Patent dated June 8, 1848.

THIS invention consists in a certain method of securing skeins of silk, to prevent the abstraction of silk therefrom, while undergoing the process of dyeing. This is effected by weaving the ends of the cord round the skein into a short piece of fabric, having a knot in the cord in the middle. A private mark may also be woven into the end as a means of identifying the articles.

Thomas Dalton, of Coventry, silk dyer, *for improvements in the manufacture of fringes, gimps, and bullions.* Patent dated June 8, 1848.

THIS invention consists, firstly, in applying the ordinary method of printing by hand blocks, and in a peculiar method of weaving, to fringes and gimps; and, secondly, in the introduction of printed weft in the manufacture of fringes or bullions of silk twist, or linen sewings.

Sir Henry Hart, Commissioner of Greenwich Hospital, Rear Admiral in our navy, *for improvements in apparatus for preventing what are called smoky chimneys.* Patent dated June 13, 1848.

THIS invention is for pumping the smoke out of a chimney by the action of the wind, and may also be used to ventilate the apartment when there is no fire. This is effected by a smoke-jack wheel in the chimney, driven by a similar wheel exposed to the wind, and kept to the wind by a cowl, as is ordinarily practised.

John Carr, of Blackburn, in the county of Lancaster, *for certain improvements in looms for weaving.* Patent dated July 3, 1848.

THESE improvements may be summed up in the claims, as follows:—First, the suddenly (when the shuttle does not complete its race, but remains in the shed), preventing the slay alone from beating up, and allowing the other moving parts of the loom to proceed until their momentum is expended. Secondly, the suddenly stopping, when the shuttle remains in the shed, the motion of the slay and the crank-arm, and allowing the other moving parts of the loom to proceed until their momentum is expended. Thirdly, the stopping the movement suddenly, when the shuttle fails to complete its race, of the momentum of the slay, the crank-arm, and the crank-shaft, and allowing the other moving parts of the loom to proceed until their momentum is expended. Fourthly, the bringing the cloth forward whenever the shuttle does not complete its race from one shuttle-box to the other. Fifthly, the use and application of caoutchouc, or other similarly elastic substance, for the purpose of lining a break, to be employed for the purpose of arresting and stopping the movements of a loom. Sixthly, the method of reducing the wear and tear of the teeth of the crank-wheel, and of the tappet wheel, by placing the fly-wheel upon the tappet-shaft, instead of upon the crank-shaft.

LIST OF ENGLISH PATENTS.

FROM 15TH MARCH, 1849, TO 3RD APRIL 1849, INCLUSIVE.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in the manufacture of piled fabrics. Patent dated March 19, six months, (communication.)

Joseph Beranger, of the firm of Beranger and Company, of Lyons, in the Republic of France, civil engineer, for improvements in weighing machines. Patent dated March 19; six months.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals and alloys of metals. Patent dated March 19; six months.

Samuel Hall, of King's Arms-yard, Coleman-street, in the city of London, civil engineer, for improvements in apparatus for effecting the combustion of fuel and consuming smoke, and for preventing explosions of steam-boilers and other accidents to which they are liable. Patent dated March 19; six months.

George Knox, of Moorgate-street, in the city of London, secretary to the Shrewsbury and Birmingham Railway Company, for improvements in railway carriages. Patent dated March 19; six months.

Alexander M'Dougall, of Longsight, in the county of Lancaster, chemist, for improvements in recovering useful products from the water used in washing, and in treating wool, woollen, and cotton fabrics, and other substances. Patent dated March 20; six months.

William Harrison Pickering, of Liverpool, merchant, for improvements in evaporating brine and certain other fluids. Patent dated March 20; six months, (communication.)

Charles William Siemens, of Birmingham, engineer, for certain improvements in engines to be worked by steam and other fluids, and in evaporating liquids. Patent dated March 20; six months.

William Parkinson, of Cottage-lane, City-road, in the county of Middlesex, gas-meter manufacturer, successor to the late Samuel Crossley, for improvements in gas and water meters, and in instruments for regulating the flow of fluids. Patent dated March 20; six months.

John Mackintosh, of Bedford-square, for improvements in furnaces and machinery for obtaining power, and in regulating, measuring and registering the flow of fluids and liquids. Patent dated March 24; six months.

Alexander Parkes, of Harborne, in the county of Stafford, chemist, for improvements in the deposition and manufacture of certain metals, and alloys of metals, and improved modes of treating and working certain metals, and alloys of metals, and in the application of the same to various useful purposes. Patent dated March 26; six months.

George Henry Manton, of Dover-street Piccadilly, gun-maker, and Josiah Harrington, of Regent-circus, gun-maker, for improvements in priming, and in apparatus for discharging, fire-arms. Patent dated March 28; six months.

Frederick William Norton, of Lascelles Hall, Lepton, in the county of York, fancy cloth manufacturer, for certain improvements in the production of figured fabrics. Patent dated March 28; six months.

François Vouillon, of Princes-street, Hanover-square, manufacturer, for improvements in making hats, caps, and bonnets. Patent dated March 28; six months.

William Hartley, of Bury, in the county of Lancaster, engineer, for certain improvements in steam-engines. Patent dated March 28; six months.

John Britten, of Birmingham, manufacturer, for certain improvements in the means, apparatus, and appliances for cooking, preserving, preparing, and storing drinks, and articles of food; and in preparing materials for constructing the same, also in constructing vertical roasting jacks, and chains for the same, applicable to other chains, parts of which improvements are applicable to other similar purposes. Patent dated March 28; six months.

James Lawrence, the elder, of Colisbrooke, in the county of Middlesex, brewer, for an improvement or improvements in brewing worts for ale, porter, and other liquors, and in storing ale, porter, and other liquors. Patent dated March 28; six months.

William Beckett, of Northwick, in the county of Chester, draper, and Samuel Powell, of Wilton, in the same county, foreman, for certain improvements in the manufacture, making, or construction of certain articles of wearing-apparel. Patent dated March 28; six months.

Osborne Reynolds, of Dedham, in the county of Essex, clerk, for certain improvements in railways. Patent dated March 28; six months.

James Fletcher, of Salford, in the county of Lancaster, manager, and Thomas Fuller, of Salford, aforesaid, machinist and tool-maker, for certain improvements in machinery, tools, or apparatus for turning, boring, planing, and cutting metals and other materials. Patent dated March 28; six months.

John Mason, of Rochdale, in the county of Lancaster, machine maker, and George Collier, of Barnsley, in the county of York, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous materials, and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same. Patent dated March 26; six months.

Stephen White, of Victoria-place, Bury, New-road, Manchester, gas engineer, for improvements in the manufacture of gases, and in the application thereof to the purposes of treating and consuming smoke; also improvements in furnaces for economizing heat, and in apparatus for the consumption of gases. Patent dated March 26; six months.

David Henderson, of the London Works, in the parish of Renfrew, Scotland, engineer, for improvements in the manufacture of metal castings. Patent dated March 26; six months.

George Thomson, of Camden-road, cabinet maker, and James Elms, of the New-road, gentleman, for improvements in machinery for cutting and tying up fire wood. Patent dated March 28; six months.

William Buckwell, of the artificial granite works, Battersea, civil engineer, for improvements in compressing or solidifying fuel and other materials. Patent dated March 28; six months.

Richard Satchell, of Rockingham, in the county of Northampton, for improvements in machinery for depositing seeds, and hoeing, and working land. Patent dated March 28; six months.

Pierre Rene Guerin, of Havre, for improvements in steering ships and other vessels. Patent dated March 28; six months.

Charles Green, of Birmingham, patent brass tube manufacturer, and James Newman, of Birmingham, manufacturer, for improvements in the manufacture of railway wheels. Patent dated March 28; six months.

James Thompson Wilson, of Glasgow, for improvements in the manufacture of sulphuric acid and alum. Patent dated March 28; six months.

Thomas Harrison, of Liverpool, merchant, for certain improvements in the construction of baking ovens, and also certain machinery for working or using the same. Patent dated March 28; six months.

Henry Howard, of Railway-place, Fenchurch-street, in the city of London, for certain improvements in the manufacture of glass, also in the construction of furnaces for melting and fining the same. Patent dated March 28; six months.

A grant of an extension of an invention for the term of four years from the 4th instant, for a certain improvement or certain improvements in the making and manufacturing of axle-trees for carriages and other cylindrical and conical shafts. To Charles Geach and Thomas Walker, assignees of James Hardy, the original inventor.

William M'Bride, jun., of Sligo, in the kingdom of Ireland, but now of Havre, in the republic of France, merchant, for improvements in the apparatus and process for converting salt water into fresh water, and in oxygenating water. Patent dated April 2; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in separating and assorting solid materials or substances of different specific gravities. Patent dated April 2; six months.—(Communication.)

Samuel Alfred Carpenter, of Birmingham, in the county of Warwick, manufacturer, for a certain improvement in, or substitute for, buckles. Patent dated April 3; six months.

Alfred Woollett, of Liverpool, artist, for improvements in gun carriages. Patent dated April 3; six months.

William Parry, of Plymouth, in the county of Devon, Esq., for certain improvements in shoeing horses, and in horse shoes. Patent dated April 3; six months.

Henry Dunington, of Nottingham, manufacturer, for improvements in the manufacture of looped fabrics, and in the making of gloves and hatbands. Patent dated April 3; six months.

James Godfrey Wilson, engineer, of Chelsea, and William Pidding, of Elizabeth-street, Pimlico, for improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable to every description of furnace and fireplace, as also to other purposes where inflammable matter or material is made use of. Patent dated April 3; six months.

LIST OF PATENTS FOR INVENTIONS SEALED IN IRELAND,

FROM THE 20th DAY of JANUARY, to the 21st DAY of MARCH, 1849, INCLUSIVE.

John Mitchell, chemist, Henry Alderson, civil engineer, and Thomas Warriner, farmer, of Lyon's Wharf, Upper Fore-street, Lambeth, in the county of Surrey, for improvements in smelting copper. Sealed Feb. 14.

William Clay, of Clifton Lodge, in the county of Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinders or rollers are used. Sealed Feb. 14.

William Martin, of St. Pierre les Calais, in the Republic of France, mechanist, for certain improvments in machinery, for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and to printing, and other like purposes. Sealed Feb. 21; six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND.

FROM THE 20TH DAY OF JANUARY TO THE 22ND DAY OF MARCH, 1849, INCLUSIVE.

William Martin, of St. Pierre les Calais, in the Republic of France, mechanist, for certain improvements in machinery for figuring textile fabrics, parts of which improvements are applicable to playing certain musical instruments, and to printing and other like purposes. Sealed January 24; six months.

Joseph Deeley, of Newport, in the county of Monmouth, engineer and iron-founder, for improvements in ovens and furnaces. Sealed January 24; six months.

Alexander Parkes, and Henry Parkes, of Birmingham, for improvements in the manufacture of metals, and alloys of metals, and in the treatment of metallic matters with various substances. Sealed January 31; six months.

Laurence Hill, junior, of Motherwell iron-works, near Hamilton, Lanarkshire, civil engineer, in consequence of a communication from Henry Burden, of Troy, in the United States of America, for improvements in the manufacture of iron, and in the machinery for producing the same. Sealed January 31; six months.

Francis Hay Thomson, of Hope-street, in the city of Glasgow, North Britain, M.D., for an improvement in smelting copper and other ores. Sealed February 2; four months.

Ewald Riepe, of Finsbury-square, in the county of Middlesex, merchant, in consequence of a communication from Antoin Lohage, residing abroad, and partly by invention of his own, for improvements in the manufacture of soap. Sealed February 5; six months.

David Napier, and James Murdock Napier, of the York-road, Lambeth, in the county of Surrey, engineers, for improvements in mariners' compasses, also in barometers, and in certain other measuring instruments. Sealed 5th February; six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Sealed 5th February; six months.

Edmund George Pinchbeck, of Fleet-street, in the city of London, for improvements in certain parts of steam engines. Sealed 5th February; six months.

James Robertson, of Great Howard-street, Liverpool, in the county of Lancaster, cooper, for improvements in the manufacture of casks and other wooden vessels, and in machinery for cutting wood for those purposes. Sealed 5th February; four months.

Fennell Allman, of 18, Charles-street, St. James's-square, Westminster, consulting engineer, for improvements in apparatus for the production of light from electricity. Sealed 7th February; four months.

Achille Chandois, of Paris, in the Republic of France, manufacturing chemist, for improvements in extracting and preparing the colouring matter from orchil. Sealed 7th February; six months.

Thomas de la Rue, of Bunhill-row, in the county of Middlesex, manufacturer, for improvements in producing ornamental surfaces to paper and other substances. Sealed 9th February; six months.

Jonah Davies and George Davies, of the Albion Iron Foundry, in the parish of Tipton, Staffordshire, iron-founders, for improvements in steam engines. Sealed 9th February; six months.

Samuel Brown, the younger, of Lambeth, in the county of Surrey, engineer, for improved apparatus for measuring and registering the flow of liquids, and in substances in a running state, which apparatus are in part also applicable to other useful purposes. Sealed 12th February; six months.

Hugh Bell, of London, Esquire, for certain improvements in aerial machines and machinery, in connection with the buoyant power produced by gaseous matter. Sealed 19th February; six months.

William Clay, of Clifton Lodge, in the county of Cumberland, engineer, for certain improvements in machinery for rolling iron or other metals, parts of which improvements are applicable to other machinery in which cylinders or rollers are used. Sealed February 19; six months.

Carey M'Clellan, of Larch Mount, in the liberties of the city of Londonderry, for an improved corn-mill. Sealed February 20; four months.

Emanuel Miller, of Baltimore, Maryland, in the United States of America, gentleman, for certain improvements in dressing or cleansing grain, and in separating extraneous matters therefrom. Sealed February 21; six months. (Communication.)

James Baird, of Gartsherrie, in the parish of Old Monkland, in the county of Lanark, in Scotland, iron master; and Alexander Whitelaw, of Gartsherrie iron works, parish and county aforesaid, manager of said works, for improvements in the method or process of manufacturing iron. Sealed February 21; four months.

Samuel Wellman Wright, of Chalford, in the county of Gloucester, civil engineer, for certain improvements in preparing various fibrous substances for spinning, and in machinery and apparatus connected therewith. Sealed February 27; six months.

Michael Loam, of Treskerley, in the parish of Gwennap, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees. Sealed February 28; six months.

William Edward Newton, of the office for patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for a certain improvement or improvements in the construction of wheels. Sealed March 5; six months.

Robert Jobson, of Holly Hall Works, near Dudley, in the County of Stafford, engineer, for improvements in the manufacture of stoves. Sealed March 5; four months.

John Smith, of Hare Craig, Dundee, factor to Lord Douglas of Douglas, for improvements in the manufacture of flour, applicable in the making of bread, biscuits and pastry. Sealed March 6; six months.

William Edwards Staite, of Throgmorton Street, in the city of London, civil engineer, for improvements in the construction of galvanic batteries, in the formation of magnets, and in the application of electricity and magnetism for the purpose of lighting and signalizing; as also, a mode or modes of employing the said galvanic batteries, or some of them, for the purpose of obtaining chemical products. Sealed March 7; six months.

Charles Thomas Pearce, of Park-road, Regent's Park, in the county of Middlesex, Esq., for improvements in apparatus for obtaining light by electric agency. Sealed March 7; six months.

Richard Lanning, of Clichy la Garenne, in the Republic of France, chemist, for improvements in the modes of obtaining or manufacturing sulphuric acid. Sealed March 9; six months.

George Nasmyth, of Great George-street, in the city of Westminster, civil engineer, for certain improvements in the construction of fire-proof flooring and roofing, which improvements are also applicable to the construction of viaducts, aqueducts, and culverts. Sealed March 12; four months.

Thomas Henry Russell, of Wednesbury, patent tube manufacturer, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron, and certain other metals and alloys of metals. Sealed March 13; six months.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters from foreign matters, and in the manufacture of candles and night lights. Sealed March 13; six months.

Charles Robert Collins, of Brunswick-street, in the city of Glasgow, North Britain, paper manufacturer, for a certain improvement or improvements in the manufacture of paper. Sealed March 14; four months.

William Edward Newton, of the office of patents, 66, Chancery-lane, in the county of Middlesex, civil engineer, for improvements in engines or apparatus, principally designed for pumping water. Sealed March 19; six months.

John Hick, of Bolton-le-Moors, in the county of Lancaster, engineer, and William Hodgson Greatrix, of Salford, in the county of Lancaster, engineer, for certain improvements in steam engines; which improvements are more particularly applicable to marine engines; and also improvements in machinery or apparatus for propelling vessels. Sealed March 16; six months.

William Galloway, and John Galloway, of Knott Mill ironworks, Hulme in the Borough of Manchester, and county of Lancaster, engineers, for certain improvements in steam engines. Sealed March 21; six months.

Thomas Robinson, of Leeds, in the county of York, flax dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. Sealed March 21; six months.

THE PATENT LAWS, AND THEIR REFORM.

Progress, progress, is the unceasing demand of the present day, and whether we look to the arena of the Arts and Sciences, or revert to the social system, we shall be met only by the re-iteration of the same demand.

In most sections of the social system the good work has already been carried to some extent; but in one of the most important, little or nothing of any consequence has hitherto been effected—that is, in the laws relating to the encouragement of Arts and Inventions. In fact, these laws appear to be usually treated with as much indifference as if they related to the beings of some other planet, and had little or no bearing on our common weal; although their object is to promote those improvements in the useful Arts, without which our proud position, as the first industrial country in the world, would be entirely lost.

But the common apathy regarding this subject is fast receding, and manufacturers and commercial men now agree that it is high time something should be done in order that the system may be placed on an equitable basis, instead of continuing in a form that tends to repress invention, and oppress inventors, and can be made a snug covert for the pretentious plagiarist.

But though the necessity for reform in the patent laws is fully admitted, still the nature of such reform remains undetermined. Every person who gives any attention to the matter having his own nostrum which he propounds as a veritable *panacea*, and which he is unwilling to sacrifice to the experience of others. Now it is well known that the only way to procure reforms of any kind is to bring "a pressure from without" to bear upon the legislature, which is both heavy and steady in character; and it is evident that no concentration of numbers and increase of pressure can be obtained whilst each party pursues a course independent of the others, instead of swelling the general combination. It is believed that this want of unity arises from the imperfect knowledge of the Patent Laws that generally exists, and therefore, it behoves the advocate of reform, first of all to inform the public as to the state of the law now existing, and then to deduce the readiest remedies; accordingly, the object of the present papers will be first to explain the existing law, and then to set forth such reforms as shall naturally suggest themselves.

The system of granting patents for new inventions appears to have sprung up along with the nefarious system of monopolies, which enabled mediœval sovereigns to raise money, or heap largesses on their favourites, by granting them these exclusive rights, fenced in with the most tyrannical regulations; it being recorded, amongst such grants, that one was made by King Edward the Third, of a patent of privilege to two aldermen, that they, and their assigns, should have the sole making of the Philosopher's Stone (Sir F. Moore's Reports—Darcy *v.* Allen), and this is not the only one granted relative to alchemy. These, however, are but exceptional cases, as may be well supposed, when it is remembered that the spirit of those times was more prone to bring charges of witchcraft, and dealing with the Evil One against inventors, as in the case of Friar Bacon, than to encourage them with exclusive rights and privileges. But, to pass from what may be considered the ages of semi-barbarism to those of the dawn of modern civilization, we find that, although the noxious system of granting mere *monopolies*

was at all times discarded by the law, as shown by a case in the time of the same king (Edward the Third), that of John Peachie (who was severely punished for procuring a license under the Great Seal, whereby it was directed that he alone, in London, should enjoy the privilege of selling sweet wines), while royal grants of exclusive privilege and protection for things newly invented by grantee were upheld (Noy Rep. 183), and we have information that such grants were repeatedly made; yet there was nothing like a well-digested system of law upon the subject, and not until the reign of James the First did this chaotic mass assume a definite and tangible form. And it certainly is a glorious feature in the reign of this king, that it brought forth a law which has not only formed the basis of our own system of patent law, but has also served as the model for most, if not all, nations who possess these valuable institutions.

This law, termed the statute of monopolies, settled two great principles of public polity; it denounced the absurd and unjust system of monopolies as contrary to law, and not to be tolerated; and declared grants of exclusive privilege and *protection for new inventions, not* to be grants for *monopolies,* and established the right and propriety of such grants in these words:—

"Provided also, and be it declared and enacted, that any declaration before mentioned shall not extend to any letters, patents, and grants of privilege for the term of fourteen years or under, hereafter to be made of the sole working or making of any manner of new manufactures, within this realm, to the true and first inventor and inventors of such manufactures, which others at the time of making such letters, patents, and grants, shall not use, so as also they be not contrary to the law, nor mischievous to the state by raising prices of commodities at home, or hurt of trade, or generally inconvenient, the said fourteen years to be accounted from the date of the first letters patents, or grants of such privileges hereafter to be made, but that the same shall be of such force as they should be if this act had never been made, and of none other."

Thus it became the settled rule of law for the future, that the first and true inventor of "*any manner of new manufacture,*" was entitled to receive the royal grant of "sole working and making" thereof, but that this exclusive right should be temporary for fourteen years.

F. W. CAMPIN.

(To be continued.)

GREAT NORTHERN RAILWAY.

SPECIFICATION OF CHAIRS.

The chairs are to be cast on Ransome and May's patent principle, and are to be precisely similar in form and equal both in strength and quality, as castings to the sample chairs now ready for examination at the Offices of Mr. Joseph Cubitt, the engineer of the Great Northern Railway Company, 6, Great George Street, Westminster.

A standard guage for the size and form of the treenail holes will be furnished; and these holes are to be cast clean and true, and of the precise size and form of the said guage. The name or initials of the maker to be cast on each chair.

The mixture of metal will be left to the contractor's own judgment; but he is to replace, at his own cost and charges, all chairs that may be broken, either in delivery or in laying of the permanent way: and the engineer is to have full power to reject all such chairs as in his opinion, are inferior in quality or strength to the sample chairs above alluded to, or to which he may object on any ground whatever; and should any dispute arise between the parties supplying the chairs and the resident engineers, agents, or contractors of the company with respect to the quality, delivery, use, or breakage of the chairs, or any other matter or thing connected with them, such dispute to be referred to the engineer, and his award thereon is to be final and binding on all parties.

The proportionate number of joint chairs and intermediate chairs is to be such as may from time to time be directed by the engineer.

The chairs are to be delivered at the ports of London, Lynn and Wisbeach, or some of them, in such numbers and at such points in the said ports as may be directed by the engineer.

The deliveries are to commence on or before Midsummer next, and eighty tons of chairs are to be delivered in each week from the commencement to the completion of the contract. The total quantity of chairs to be supplied is four thousand tons.

Payment will be made on the certificate of the engineer, but ten per cent. to be deducted from the amount of each delivery until the sum so deducted shall amount to one thousand pounds, which amount of one thousand pounds is to be retained in the hands of the company at four per cent. interest, as a guarantee fund for the due and proper performance of the contract until twelve months after the total quantity of chairs shall be delivered and be so certified by the engineer; and if in any case, defects should be discovered in chairs which have been previously certified, the engineer is to have full power to deduct the cost of remedying such defects from the said fund.

Tenders must be sent in upon the annexed form, and be delivered before twelve o'clock at noon on Tuesday the 20th instant, at the offices of the Great Northern Railway Company, 14, Moorgate Street, London, sealed up and under cover addressed to J. R. Mowatt, Esq., Secretary, Great Northern Railway Offices, 14, Moorgate Street, London; they must be marked on the outside—"Tender for Chairs;" and parties tendering must be then in attendance. The directors do not bind themselves to accept the lowest tender.

6, Great George Street, Westminster,
March, 1849.

SIR, *March,* 1849.

I have examined the sample chairs at the offices of Mr. Joseph Cubitt, the engineer of the Great Northern Railway Company; and I now hereby offer to supply the Great Northern Railway Company with four thousand tons of chairs in accordance with the annexed specification, and with all the terms and conditions therein contained, for the sum of pounds shillings and pence (£) per ton.

I am, Sir,
Your obedient servant.

To J. R. MOWATT, ESQ,
Secretary.
Great Northern Railway Offices, 14, Moorgate Street, London.

THE SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Tuesday, March 27, 1849.

WILLIAM CUBITT, ESQ., Vice-President in the Chair.

THE Paper read was a "Description of the Groynes formed on the South Rocks, the site of the new docks at Sunderland," by Mr. W. Browne, Assoc. Inst. C.E. These groynes have been erected for the purpose of retaining the deposited materials excavated from the new docks, and of arresting the sand and shingle which naturally travel southward, in order to form a barrier beach, that should effectually exclude the sea from beyond a given line. The three first, whose lengths varied from 326 feet to 358 feet, were erected at a height above ordinary high-water mark of 2 feet 6 inches and 10 feet at the seaward and inner ends respectively. The exterior was composed of ashlar work; the interior partly of the excavated magnesian limestone, and partly of rubble set in mortar; the batter of the north sides was two and a half inches to a foot, that of the south sides one to one, and the crest was formed into an arch, with a radius of 5 feet 6 inches. The four other groynes were constructed of a different form, in consequence of those first erected not retaining the deposited excavation, and accumulating other materials as was desirable, and from their having been injured by the sea, during a heavy storm, which occurred at the time of the equinoctial tides, during the spring of 1848, when a breach was made in the first and third groynes, and at the same time some of the stones in the second groyne were loosened; these effects were produced at about the same point

in each, namely, the intersection of the inclination of the groyne with the line of ordinary high-water mark; and it was found, from observation, that the momentum of the waves was greatest at or about the time of high-water. The sides of these groynes were semi-cycloidal, each being generated by a circle of 12 feet 9 inches in diameter, and uniting at the apex; the seaward and inner ends are respectively 7 feet and 10 feet above ordinary high-water mark, and their lengths varied from 510 feet to 579 feet; the foundations of these groynes consisted of a course of freestone, laid at an average depth of 2 feet below the surface; the sides were also of coursed freestone, set header and stretcher alternately, and the hearting of large sized rubble, closely packed, the vacancies between it and the ashlar work being filled with small stones set in Roman cement, so as to ensure a solid bed; at a depth of 6 feet below the crest of the groyne, and resting upon the rubble hearting, coursed ashlar was introduced, and carried as near to the crest as possible, the vacancy being filled with small rubble and Roman cement. The construction of these groynes commenced at the sea-ward point, and they were placed at distances of from 350 to 450 feet apart; the quantity of material excavated and deposited between them was stated to amount already to 730,000 cubic yards; it consisted partly of hard blue clay and partly of marly rock or soft magnesian limestone, and the barrier beach formed by them had completely withstood all the gales which occurred during the winters of 1847-8, and 1848-9.

Some very interesting information was given as to the action of the tide in the Wear, and the reasons for the construction of the new docks, which were stated to promise to be of immense importance to the trade of that port.

During the discussion, Mr. Murray explained very clearly his views in the design of the docks, and for the direction of the groynes, and the various works in the harbour for arresting the waves in their progress up the river. This investigation of this subject elicited some very interesting remarks as to the action of waves striking walls and groynes at various angles, when instead of being entirely reflected, they were in part retained and guided along the face. This was a peculiarity which, it was stated, should be taken advantage of in hydraulic works.

Tuesday, April 3, 1849.

William Cubitt, Esq., Vice-President in the Chair.

The discussion on Mr. Brown's "Account of the Groynes at the new harbour at Sunderland," was continued throughout the meeting.

At the monthly ballot, the following candidates were duly elected:— Mr. W. B. Clegram, J. Fenton, J. Matthew, and W. Radford, as Members; the Right Hon. the Earl of Lovelace, W. G. Armstrong, J. Chubb. J. Francis, Sören Hjorth, and W. Piper, as Associates.

Tuesday, April 17, 1849.

Robert Stephenson, Esq., M.P., V.P., in the Chair.

The paper read, was "On an application of certain Liquid Hydrocarbons to Artificial Illumination," by Mr. C. B. Mansfield, B.A. The paper first noticed, that liquid hydrocarbons had been comparatively little used for the production of artficial light; and that in the instances in which they had been applied, their liquidity, and not their evaporability, had been turned to account.

In the use of the common volatile oils, the excess of carbon in their composition was the great difficulty; but when that was surmounted, that excess became an actual benefit.

There were two methods of rendering this carbon efficient as "light fuel," when advantage was taken of the volatility of the substances: one was, to cause the vapour, as it escaped from a jet, to mix rapidly with the air. The other, to mix the vapour, before combustion, with other gaseous matters containing less carbon. The adoption of the first of these was instanced in Holliday's recently patented Naptha Lamp. The second, consisted of the new arrangements described in the paper.

This principle was carried into practice in two ways. The first (which was illustrated by a lamp that was burning on the table) was effected by mixing the hydrocarbons with some other inflammable spirit containing very little carbon. The mixture was described as being made in certain definite proportions, which ensured a perfectly white light, and from which any deviation would result in a flame of inferior quality—pale if the hydrocarbon were deficient,—smoky, if the mixture were poor in spirit. The ingredients most accessible in this country were stated to be, wood-spirit, and a volatile oil from coal naptha, in the proportions of two-thirds of the former to one-third of the latter. Alcohol and oil of turpentine had been similarly used on the continent, though the former was too dear for use in England.

The other adaptation of the same principle, and that which it was the chief object of the paper to describe, was the dilution of the hydrocarbon vapours with permanent gases of inferior, or even of no illuminating powers.

That application might be called the napthalization of gas, or the gasization of naptha, according as its main object was to enhance the services of the gas, or to utilize the liquid: the latter was the object of the new proposal described in the paper. The former had been already accomplished by preceding inventors.

The first invention was that of Mr. Donovan in 1830, who proposed to confer illuminating power on gases that were inflammable, but not luminiferous, by charging them with the vapour of Hydrocarbons; but from the want of a sufficiently volatile fluid, he was compelled to have a reservoir close to every burner. The next application was that of Mr. Lowe, who increased the light obtained from coal gas by passing it over surfaces of naptha. Mr. Beale's air light was then noticed; its object was to use hydrocarbons for illumination, by passing a current of air through vessels containing those liquids. There existed, however, the same obstacles to this plan as to that of Mr. Donovan, viz., the heat required to evaporate the only liquid hydrocarbons then accessible.

The paper represented that at length the difficulty had been solved by the discovery of a liquid hydrocarbon, as volatile as spirits of wine, but containing sufficient carbon for the most perfect light, and obtainable in any quantity. This hydrocarbon was procured from coal tar, and was called "Benzole." Its volatility was such as to enable it to napthalize atmospheric air as effectually as ordinary naptha did coal gas.

The system proposed by the author (which was illustrated in the room by a working apparatus) consisted in conducting a stream of almost any gas, or even of atmospheric air, through a reservoir charged with Benzole or some other equally volatile hydrocarbon; the gas or air so napthalized being then conducted like common coal gas through pipes to the burners. It was stated, that the system was applicable on any scale, from the dimensions of town gas works to the compass of a table lamp. In the apparatus exhibited, a small gas-holder, filled by a pair of bellows, supplied common air through pipes. The gases formed by passing steam over red-hot coke would answer well for this purpose, and it would depend on local circumstances whether this mode of generating the current would be preferable to the expenditure of the mechanical force necessary for driving atmospheric air through the pipes. Pure oxygen charged with the vapour would explode on ignition; it was therefore suggested that this might prove a useful source of motive force. It was, however, stated to be difficult to form an explosive mixture of the vapour with common air. By decomposing water with the voltaic battery, napthalizing the hydrogen with Benzole, and burning it with the aid of the equivalently liberated oxygen, a simple light of intense power might be obtained. The system was shown to be a great simplification of the ordinary system of gas-lighting, as no retorts, refrigerators, purifiers, or meters were required, and the products of combustion were as pure as those from the finest wax. It was expected that the elegance of the material and the simplicity of the apparatus would induce its introduction into buildings and apartments where coal gas was not now considered admissible.

The apparatus and conditions necessary for the success of the method were, a flow of cheap gas, or of air, driven through pipes by any known motive power, and a reservoir of the volatile spirit through which the main pipe must pass in some convenient part of its course; these pipes and reservoirs being protected from the cold. It was stated, that though the liquid did not require to be heated above the average tem-

perature of the air, it was liable to become cooled by its own evaporation, so as to require an artificial supply of warmth. This was readily effected by causing a small jet of flame of the gas itself to play upon the reservoir, and by a simple contrivance, called a "Thermostat," by which the flame was shut off when necessary, the temperature could be made self-regulating, so as never to rise above or fall below a proper degree. The cooling due to the evaporation would, of course, be inversely proportionate to the quantity of liquid in the reservoir. If atmospheric air was used as the vehicle for the vapour, the jet holes in the burner, from which it escaped for combustion must be slightly larger than those for coal gas. Some burners, contrived for the purpose of accurately adjusting the size of the orifice to the quantity of luminiferous matter escaping, were exhibited and described; they were made so that by moving a part of the burner, any required quality of flame, from lightless blue to smoky, could be obtained, there being a medium point at which the most perfect brilliancy was arrived at. The burners would answer equally well for coal gas, though that material could not, even by them, be made to evolve so white and pure a light as that from Benzole vapour.

In conclusion, some data were given on which a calculation of price was founded.

It was stated, that a gallon of Benzole, of the degree of purity requisite for the purpose, would cost about two shillings and sixpence; to this, the expense of the air current and the interest of the original outlay on apparatus was to be added. This the author presumed would not raise the cost to more than four shillings for the consumption of a gallon of Benzole. It was stated that one ounce of that liquid would give a light equal to four wax candles, of four to the pound, for one hour; or one gallon for about one hundred and twenty hours. It was inferred, that a gallon of this material was equivalent to about one thousand cubic feet of coal gas.

Finally, for comparison with coal gas at a distance from the mines, it was stated, that while to produce one thousand cubic feet of gas, at least two hundred pounds of coal must be transported, one gallon of Benzole did not weigh more than seven pounds; this, in carriage, would give Benzole an advantage of twenty-eight to one over coal as a source of light.

In the discussion which ensued, high encomiums were passed upon the talent and patient labour exhibited by Mr. Mansfield in the investigation of this important subject, which promised to lead to most remarkable results, as an extension of gas lighting to positions where it had not before been considered applicable.

The paper announced to be read at the meeting of Tuesday, April 24th, was "On Locomotive Engines," by Mr. T. R. Crampton, Assoc. Inst. C. E.

SOCIETY OF ARTS.

April 11th.

B. ROTCH, ESQ., Vice-President, in the chair.

The secretary read a short paper by Baron de Suarcé on the Oxalis Crenata, specimens of which were exhibited.

The Oxalis Crenata has been known to the scientific agriculturists of Europe for some years; it is a tubercle, the culture of which however, upon a large scale, has been little practised. This tubercle is stated by Baron de Suarcé (who has cultivated about two acres and a half of it upon his own estate in the south of France) to possess a larger degree of nutriment than most of the farinaceous plants which form the basis of human food in our climate. The total weight of the crop produced upon two acres and a half cultivated by him was 10 tons, from which 3 tons of flour was obtained.

From the stems of the plant which may be cut twice a year, and can be eaten as a salad or spinach, 90 gallons of a strong acid was obtained, which when mixed with three times its bulk of water, was well adapted for drink. The acid, if fermented and brought to an equal degree of acidity with vinegar, is superior to the latter when used for curing or preserving meat, as it does not render it hard or communicate to it a bad flavor.

The flour obtained from the Oxalis Crenata is superior to that obtained from the potato, maize, or buckwheat, as it makes an excellent light bread when mixed in the proportion of one-fourth with corn flour; this is not the case with potato, maize or buckwheat flour.

The Baron concluded his paper by expressing his willingness to make any further communication to the society on the subject they might desire, as he would consider it a great happiness to be enabled, with the aid of the society, to introduce into England the culture of a tubercle which seems destined to become a source of food for the lower classes more precious perhaps, than even the potato.

In reply to a series of questions, the Baron stated that the Oxalis Crenata came originally from South America—that it is hardy and unaffected by change of temperature, and grows readily in any soils, it being difficult when once introduced, to eradicate it.

The thanks of the meeting were presented to the author for his communication.

Dr. Ayres read a paper on the importance of the animal refuse of towns as a manure, and the methods of rendering it available to agricultural purposes.

The author commenced his paper by calling attention to the necessity of preserving the animal refuse of towns, and the importance which is attached to it in China and Flanders, in many departments of France, Tuscany, &c., and also to the various forms in which it is applied to the earth.

Having alluded to the importance of this subject in connection with the improvement of the sanitary condition of towns, and the injurious effects upon the inhabitants of London in particular, by allowing the putrid matter to be carried into the Thames, there to be tossed upon the waves and left exposed upon the shores at each retrocession of the tide; he proceeded to consider the value of the contents of the cesspools of London alone, which he has calculated cannot yield less than 46,500 tons of perfectly dry matter annually—a quantity, according to the analysis of Liebig, sufficient to fertilize, at least, a million acres of land, and the monetary value of which cannot be stated at less than £340,000. Having next alluded to the plans which have hitherto been proposed for drying and rendering this great mass of matter portable and available for agricultural purposes, he proceeded to describe a plan which he has recently patented for effecting so desirable an object.

My process (he observed) essentially depends on the fact that all the gaseous and volatile products of putrefaction are combustible, and are resolved into the ordinary products of combustion, when carried over any incandescent surface, or over or through burning fuel, when mixed with atmospheric air. Thus ammonia is resolved into nitrogen and water, sulphuretted hydrogen into sulphurous acid and water; carburetted hydrogen into carbonic acid and water; phosphoretted hydrogen into phosphoric acid and water; the volatile organic matters associated with the gases are completely destroyed; carbonic acid alone passes through the fire unchanged. All these gases, with the exception of ammonia and carbonic acid, exist only in very small proportions in putrescent animal matter. It follows from what has been stated, that all the volatile products of putrefaction are thus resolveable into the ordinary products of combustion, which are well-known to be innocuous. It suffices to conduct these gases and vapours through a fire to effect their entire decomposition and destruction.

The apparatus by which this process may be worked is susceptible of many modifications, but those to which he particularly desired to direct the attention of the society, consists in drying the animal refuse by the application of heats either obtained from steam pipes or otherwise, and at the same time, destroying the volatile products of putrefaction by burning them.

A lengthened discussion followed the reading of the paper, at the close of which, the thanks of the meeting were presented to Dr. Ayres for his communication.

April 18th,

THOMAS WEBSTER, Esq. F.R.S., Vice President, in the Chair.

Mr. F. Pellatt read a paper on the supposed influence of oxygen on the colour or tint of flint glass.

The author, in commencing his paper, stated that the remarks contained in ihe same are entirely the result of experience in the manufacture of glass in large quantities, it being only under such circumstances that many of the

changes there noticed can be observed, because they are so minute, that in dealing with small qnantities, their occurrence would not be perceptible. In speaking of white glass, the term is comparative, as no glass is perfectly colourless, and to the practised eye of the glass maker, there exists no two pieces of the same tint or shade, the word colour therefore is used to denote that particular tint or shade, whatever it be, which all white transparent glass possesses. With these remarks, the author proceeded to consider the action of oxygen as affecting the colour of flint glass in two distinct particulars. First, its action upon the glass mixture during its melting or founding, whilst in a state of fusion; and secondly, during its annealing or gradual cooling.

The constituents of flint glass, are silica, lead, carbonate of potash, and nitrate of potash. The silica is found sufficiently pure as fine sand, which abounds in some districts; that from Allum Bay, Isle of Wight, is much esteemed. The protoxide of lead, litharge, or the deutoxide, red lead, is the state in which the lead is used, and the potash is the ordinary curl and nitrate of potash of commerce. These, when mixed in certain proportions, and subject to a strong heat for 60 or 70 hours, produce flint glass. The purer the metal, the more transparent the glass, but although all the materials be chemically pure, colourless glass is not the product, owing to some chemical change which takes place during the melting; the glass is tinted with green. This is generally stated to arise from the presence of oxide of iron, but the author believes that, in most instances, it is owing to to the want of a necessary proportion of oxygen in the mixture, which the following experience will go far to prove.

The tint of green is always minus when the lead in the glass mixture is in the highest state of oxygenation, that is, when red lead is used, and lowest when the litharge is employed in the mixture. When an excess of carbonate of potash is used, the green tint is deep, but may be entirely overcome by the use of the nitrate of potash, and superseded by a purple tint, when no metal but lead is present.

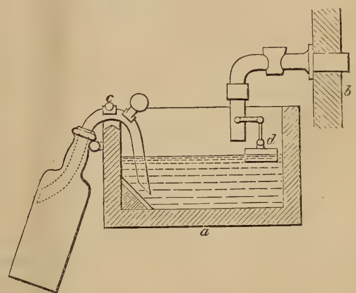
Oxygen being the agent by which these changes in the colour of the glass are effected, the glass maker, in order to overcome the green tint always present when oxygen is minus, uses the oxide of manganese, which has the property of giving off its oxygen very slowly. An excess of manganese gives to glass a purple tint, and where altogether absent, the glass is always green.

Having thus called attention to the peculiar composition and mode of manufacturing flint glass, he proceeded to describe the changes which take place in the colour or tint of glass, and the methods employed by the glass manufacturer to convert the mass from a green, purple, amber, or other tint to a pure or colourless metal, and brought forward examples tending to prove that the changes in the colour of glass are due to the presence or absence of a given proportion of oxygen. Manganese, as a metal, gives no colour to glass, although, by the oxygen, it yields to the lead in the mixture, a purple colour is produced, because by reducing the quantity of oxygen, either by polling or subjecting the glass to a long continued heat, or by submitting it to the action of carbon, the purple colour is removed, though the manganese still remains. Iron and copper also assume different colour when combined with different proportions of oxygen. If this be true, may not all colours of the oxygen of other metals, such as iron, copper, and lead, be due to the combination of certain proportions of oxygen, with the metal or metals present, so as to induce a particular molecular arrangement, from which the glass has the power of absorbing a particular colour.

A lengthened discussion followed the reading of the paper, in which Mr. A. Pellatt, Mr. Christie, Mr. Wilson, Mr. Palmer, and other gentlemen connected with the manufacture took part, at the close of which, the thanks of the meeting were presented to Mr. F. Pellatt, for his communication.

MASTERMAN'S PATENT BOTTLING AND CORKING MACHINES.

Although these machines are well known amongst the trade, yet, as there are probably many of our readers, who have neither the time nor the opportunity for diving into the arcana of the gloomy store-houses of Stout and Double X, we think a description of them may be useful. To properly appreciate the difficulty of bottling from the cask, you ought to try it yourself, good reader.—Buy a cask—of wine—we were going to say, but we find beer all *we* can afford to wash down the income tax with, and let it stand a day or two with the vent peg out to allow the beer to become *flat* before it is bottled. Then having the beer-tap driven in, and all the bottles cleaned, corks ready, &c., you will, if a novice, think it the easiest matter in the world to get through your job, some fine evening. You will find, however, that "there are more secrets in bottling, than are dreamed of in your philosophy." First, the beer is to be drawn into a jug,—then it has to be poured carefully into the bottle, in doing which it is almost impossible to avoid frothing it, which prevents it being filled so full as is desirable, (for the less air is left in the bottle, the sooner will the beer become in condition for drinking), and finally the cork, after being dipped in the beer to diminish the friction, has to be driven into the bottle with a mallet, in doing which, if the bottle be filled in the least too full, it will be inevitably cracked, from the end of the cork pressing on the liquor. A little experience will render all this easy enough, but still where large quantities have to be dealt with, the time occupied becomes a serious consideration.



The machine, of which the annexed cut is a sectional end view, is for the purpose of filling the bottles to an exact point, without any attention on the part of the operator. *a* is a section of a trough, which is supported at each end by a tressle, with pins by which its height can be adjusted, *b* is the cask containing the liquor to be bottled, *d* is a float and throttle-valve apparatus, attached to an ordinary cock in the cask. The use of this apparatus is to preserve the liquor in the trough at an uniform level, the float rising and shutting the valve when the liquor rises, and *vice versa; c* is a syphon, of which there are 4 or more in one machine, free to move on the centre *c*. When there is not a bottle hung on the syphon, the weight at top keeps the inner end down against a strip of leather, attached to the corner piece inside the trough, and prevents the liquor from escaping; but as soon as the bottle is hung on, its weight lifts the inner end, and the liquor will run into the bottle until it arrives at the same level in it as in the trough. It then stops, and the bottle may be removed at convenience, and corked. There being 4 syphons, four bottles can be hung on at once, and while one is being corked, others are filled; neither is any froth formed, so that the bottles can be filled to the precise point at once, without any waste.

The corking machine is of equal simplicity and efficiency.

The bottle is put into a wooden socket, supported in a frame and capable of being raised by a lever on which the operator's foot presses; over the bottle is a transverse frame containing three metal sockets for as many different sized corks. The lower end of this socket is made a little smaller than the mouth of the bottle for which it is intended. Over the transverse frame is a bar carrying three punches which fit the three sockets, and this bar can, by the side rods and lever attached to it, be raised and depressed by the hand of the operator. The bottle is put into its place, the cork dropped into the socket, and by a simultaneous motion of the hand and foot, the bottle is raised in contact with the socket, and the cork forced through the socket into the bottle. The cork being compressed in passing through the socket, there is very little strain thrown on the bottle, and it is so tightly corked that no wiring is required. With the use of the two machines, two workmen can bottle and cork forty dozen in an hour, with ease.

ANALYSIS OF BOOKS.

Companion to the Improved Log-Book for Steam-vessels. By PETER BORRIE. London.

THE progress of Steam Navigation during the last ten years has been so rapid, and has become such an important element of the prosperity of this country that any plan, tending to the improvement of a system on which so much depends, deserves our most careful consideration. The points to which attention has been hitherto chiefly directed, have been increased speed and diminution of the weight and bulk of the engines and boilers. The substitution of wrought, for cast iron in various parts of the engines, and the use of tubular boilers, allowing of a higher pressure of steam, have effected great improvements in these respects. The points which have been most neglected have been the economy of fuel and the durability of the machinery. Speed is so apt to be considered the sole criterion of success, that but little inducement has been held out to engineers and officers to study the pockets of the owners. Competition, however, works wonders. The railway companies find it to their interest to give the engine drivers premiums according to their economy of coke, and we apprehend that the only reason which deters steam-boat companies from doing the same thing, arises from the divided responsibility of the engineer and the captain, and the presumed difficulty of forming a correct estimate of the various qualifying circumstances incidental to a sea voyage.

The work before us, to a certain extent, meets this difficulty. A glance at the subjoined form of log-book will show that such a record of the operations of the engine room is aimed at, as will enable the owners of a vessel to ascertain at all times, whether due attention has been paid to the machinery. A chief officer's log accompanies the engineer's log, giving the usual particulars of the courses, bearings, sails set, barometer, &c., into which we need not now enter, the observations in both cases being made hourly. Details of all the duties of the engineer as regards the engines and boilers are given, with suggestions to remedy the various accidents to which they are liable. The indicator is fully explained, and instructions given for its use. The description of the dynamometer for screw-propellers, we extract for the benefit of our readers :—

"The dynamometer is an instrument consisting of a lever or combination of levers, so fixed as to receive all the forward thrust of the propeller shaft, and which, acting on a spring balance, thereby indicates the amount of this thrust or pressure in pounds. This lever is sometimes made to take the pressure from the end of the shaft, but in general this is not so convenient as to have it taken from a revolving frame, having a number of friction rollers in it working against a collar upon the shaft, as by this means it can be taken from any part of the shaft that is most convenient. The lever or levers should have knife edge centres, so as to work with as little friction as possible, and the rod connecting the lever to the spring balance should have a small sliding rod attached to it, which carries a pencil. Alongside of this rod is a barrel on which a piece of paper can be fixed as in the indicator, and this barrel is made to revolve by means of a strap or band, connecting it to the propeller shaft, which strap passes round pullies on the barrel and shaft, so proportioned that the speed of the barrel is considerably less than that of the shaft. The pencil is brought in contact with the paper on the barrel, and a zero line traced before the pressure of the shaft is brought upon the lever. It should then be disengaged from the paper, and the connecting rod of the lever screwed up until the whole forward pressure of the shaft comes upon the lever, and the shaft runs clear of every other part that might receive its pressure. The pencil now being brought into contact with the paper, an undulating line will be described on it, which will show the action of the engines on the propeller. After the diagram is traced, take off the paper and draw a number of equidistant lines at right angles to the zero line, and the length of the lines measured from the curve to the zero line upon the scale of pounds of the spring balance, will give the action of the lever upon the balance at these particular points, which should be marked upon the diagram at their proper places; then, if the sum of the forces thus found at all the divisions be divided by the number of parts into which the diagram is divided, the mean force on the lever will be obtained, and this being multiplied by the leverage will give the average forward pressure exerted by the propeller shaft upon the vessel. If it is only a single lever that is used for the dynamometer, the leverage is found by dividing the length from the fulcrum to the point where the rod to the spring balance is attached, by the length between the fulcrum and the point which receives the pressure of the shaft: but if it is a compound lever that is used, multiply together all the long arms of the levers, and divide the product by the product of all the short arms, (measuring the lengths from the fulcrum of each lever,) and the quotient is the leverage.

"The forward pressure in pounds exerted by the propeller shaft having been found, the number of horses' power may be calculated by multiplying the pressure by the velocity of the vessel in feet per minute, and dividing the product by 33,000."

It will, no doubt, occur to the reader, on observing, "State of throttle valve, larboard and starboard, rate of expansion, vacuum, &c., in the log, what a vast deal of trouble would be saved if an efficient and continuous indicator could be devised.

It must be observed that the spaces in the log-book below are contracted to bring it within our pages. We need hardly add, in conclusion, that the work is one which we can confidently recommend as a safe guide to the practical man.

From..*towards*..

CHIEF ENGINEER'S LOG.

HOURS.	No. of Fires.	Steam Gauge.	State of Throttle Valve.		EXPANSION.	Barometer at Condenser.		THERMOMETER.			Revolutions per	Propeller or Paddle Wheels.					Distance run.		REMARKS, ETC.
			L.	S.		L.	S.	Atmosphere.	Hotwell. L.	Hotwell. S.		Diameter.	Pitch.	No. of Blades or Floats.	Area of each Blade or Float.	Slip.	Knots.	Fathoms.	18
1 P.M.																			
2																			
12																			

NAME.	COALS.	TALLOW.	OIL.	ROPE YARN.	Number of Hours Steaming.	Number of Hours Sail set.	IMMERSION.	
	Tons Cwt. lbs.	Cwt. lbs.	Galls. pts. gills	Cwt. lbs.			Forward.	Aft.
QUANTITY.								
EXPENDED.								
REMAINS.								

Davies's Rotary Engine, an Experimental Enquiry. By WILLIAM DREDGE, C.E.

THIS pamphlet is, for the most part, the substance of a report made by Mr. Dredge, on a rotary engine which had been erected at the works of Messrs. Edelsten and Williams, Birmingham, by the inventor, Mr. Isaiah Davies. Mr. Dredge undertook the examination, we are told, with a strong opinion against rotary engines, but subsequent experiments have given him reason to draw the following conclusions:—"And I would observe, that after having carefully considered every point in reference to this engine, and critically examined its practical and working detail, both as regards its capability in giving off work, and its efficiency to withstand wear and tear, I can, without hesitation, express my unqualified approbation of Davies's engine, and certainly think that ere long, it must maintain in the market, a favourable competition with others."

The engine consists of an elliptical piston, revolving in a cylinder, the abutments for the steam consisting of two slide valves, the whole width of the cylinder, and sliding in grooves cut in the ends of it. This is Mr. Davies' last arrangement, the engine on which Mr. Dredge more particularly experimented, having only one projection on the piston, and one sliding abutment. The double arrangement gives double the power, with the same diameter of cylinder, and also relieves the shaft of much of the torsion. These sliding abutments, which, in fact, are the steam slides, are worked by a cam and weigh shaft, as usual. The engine is reversed by moving a slide, which converts the steam passages into exhaust passages, and *vice versa*, as in other rotary engines. The inner end of the piston bears against the end of the cylinder, and the outer end has a loose plate brought up to it by set screws. The projecting part of the piston has a tongue let into a groove in it, and kept out, by springs under, against the inside of the cylinder. A packing plate is brought down on the top of the sliding abutment by set screws. The ends of the revolving shaft pass through stuffing boxes, with metallic packing, formed of segments of brass, with spiral springs behind them. The piston is keyed on to the shaft, so as to allow of a slight end motion, in order that any end strain upon the shaft may not be thrown upon the end of the cylinder.

Mr. Dredge made a number of experiments on the gross power exerted by the engine, on the friction, and on the consumption of fuel, which we shall briefly notice. The engine at Messrs. Edelsten and Williams' factory, (or rather the pair of engines, for there are two cylinders and two pistons, at right angles, upon a shaft), has a pair of cylinders of 24 inches diameter, and 15 inches deep, and makes 70 revolutions per minute. When loaded to about 10 horses' power, and with 18lbs. steam in the boiler, the water evaporated was 9.8 cubic feet, and the coal consumed (common slack) 86lbs. per hour. The power under these circumstances, is estimated at 11.18 horses, but the friction break showed the amount of work actually given off, to be only 10.2 horses, leaving about 10 per cent. loss by the friction of the parts, &c.

Mr. Dredge reduces his calculations as to the consumption of fuel, to the standard of the best Welsh coal, one pound of which, he supposes capable of evaporating 9.5lbs. of water—this would give a consumption of 6.3lbs. per horse power, per hour, for the rotary engine. In further experiments, the pressure in the boiler was increased to 30lbs., and the horse power given off by the friction break to 15.99. As even this latter pressure may be considered below the requirements of actual practice, we should have liked to have seen the consumption of fuel tested under these circumstances.

Mr. Dredge draws the following deductions from his experiments:—

"If I am asked what advantages Davies's engine possesses, I should reply:—

First. Economy in prime cost.

Second. It occupies considerably less space than an ordinary engine of similar power would do.

Third. It possesses the advantage of having the rotary power generated upon the main shaft, or of communicating power by direct action.

Fourth. It does not consume so much fuel, as a non-condensing reciprocating engine would do, and

Fifth. The facility possessed by the engine man, of starting, stopping, or reversing in an instant.

As our conclusions do not agree with Mr. Dredge's, we will briefly state our reasons for dissenting.

First. "As to the economy of the prime cost." It would not be difficult, though it would take more time than we can spare, to calculate the different quantities of boring, turning, planing, &c., in one of these engines, as compared with a direct-acting reciprocating engine, of the same power, and we are confident that the rotary would not stand the comparison. There is, however, another question which would materially influence this point of the argument. Is this engine capable of moving at a greater speed than 70 revolutions per minute, with safety and economy? If so, the price per horse power would be proportionately diminished.

Second. "As to the space occupied." In this respect, we cannot admit that this engine has any advantage over an oscillating engine, for general purposes, although, looking at it in connection with,

Thirdly. "The direct application of the power," it would have an advantage for marine engines, where a fly-wheel is not required.

Fourth. "The economy of fuel." We must confess that we are more surprised at this argument than at any of the others. Mr. Dredge devotes the opening chapter to proving that there is no abstract reason why a rotary engine should not use the steam as advantageously, as a reciprocating engine, an argument which we freely admit, but, as the converse is equally true, the only advantage that could be gained by the rotary, would be in the diminution of the friction, a point which we are not prepared to concede, until an experience of a few years, with a much higher pressure of steam, than the engine in question has been worked at, should justify it. In a note, Mr. Dredge states that "he believes that he is correct in saying that the duty performed by Davies's engine, at Messrs. Edelsten and Williams's (though it is a high pressure (*non condensing*—ED.) engine, is greater than the average of low pressure (*condensing*—ED.) engines; or, in other words, that taking the average of low pressure engines, they consume more than 6.3lbs. per horse power, per hour." Now, it must be remembered that the power here mentioned, is the *actual* horse power, and that a high standard is taken for the Welsh coal, higher than is obtained in actual practice; neither have we much faith in evaporating experiments, in a general way, as a great deal of water is often carried over by the steam. We would rather form an opinion from the contruction of the engine, and, as we see no reason why it should be more economical than a reciprocating engine, so we are willing to admit that it may be equal to it, in that respect.

Fifthly. "The ease with which the engine may be reversed." This is not a very important benefit, but such as it is, it is shared by most of the rotary class, and also by the most approved arrangements of locomotive and marine reciprocating engines. It is advantageous to have the means of instantaneously reversing an engine, but the power ought to be discreetly used, or the engine will be violently strained. We have now touched upon the main points of Mr. Dredge's report, and are happy to bear testimony to the practical knowledge and fairness of experiment which it evinces, however much we may dissent from its conclusions. From an appendix to the report we learn that in November last, Messrs. Edelsten and Williams expressed themselves perfectly satisfied with the efficiency and regularity of the engine, it having then been at work for upwards of a twelvemonth. The gland packing is stated by Mr. Dredge to be as good as when first put down. The same principle has been applied to the cylinder stuffing-box of an engine of 90 horse nominal power, and with equally satisfactory results.

SUPPLY OF WATER.—At the last returns there were 70,000 houses out of 270,000 that had no water supply whatever; and though it is asserted that the number has since diminished, the supply of water to the poor in general is so exceedingly scanty in many districts, that it is practically a perfect mockery. Seventy thousand houses inhabited by the poor, with an average of only two families to a house, would give 700,000 persons who have to beg or steal water every day for the ordinary necessities of existence. Although the practice of reducing to figures and to a money value, the sanitary ills endured, is to a certain extent a pandering to the vicious system which prompts an Englishman always, when first considering a new project, to regard it in a mere money point of view, still it has its benefits in being an *argumentum ad hominem*, of no inconsiderable value, in determining a speedy conclusion. Now, if the very hardness of the water of London alone leads to an outlay of soap and soda of, at the least, double the amount absolutely requisite, and that amount be £630,000, it is surely worth while to determine whether an actual waste of £315,000 should be annually tolerated in the metropolis. But if we embrace the moral and physical evils, and combine with them the sum of the pecuniary loss entailed by the present scanty and intermittent supply of impure, often dirty, water to London, such an array of facts would stand forth as to cause every inhabitant to cry shame upon those whose duty it should happen to be to present a remedy for such a condition of things.—*Health of Towns Journal.*

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(Continued from page 95).

JOINER.

Joiner's Work to Water-Closets, Urinals, Sinks, Cisterns, &c.

Lloyd's Rooms.—There is to be a slate cistern in the basement, of the prime-cost value of £10; four water-closets, four urinals, and four cisterns on the ground story; four water-closets, four urinals, and four cisterns on the mezzanine story; and five water-closets and two cisterns on the second story. Form enclosures, with 2-inch bead flush two sides partitions, on the second floor, with $1\frac{1}{2}$-inch deal doors to match, and line ceilings and backs of closets with $\frac{5}{8}$-inch matched linings out of battens.

N.B. All linings to sides and ceilings of water-closets to be out of battens; and provide and fix in all cases $1\frac{1}{4}$-inch framed, beaded, and rebated grounds $3\frac{1}{2}$-inches wide, all round the ceilings, and to tops and bottoms of linings to sides, to receive the linings which are to be rebated, and part nailed and part screwed to them. The divisions to be 8-feet high, and lay over them $1\frac{1}{4}$-inch batten floor and joists 10 by $2\frac{1}{2}$, and plates 4 by $2\frac{1}{2}$ on four iron bearers or sockets; the framing in front 10-feet high, and part higher to the extent of 11-feet by 4-feet 6 in hopper of skylight. The doors to be 2-feet 3 by 6-feet 6, hung with $3\frac{1}{2}$-inch butt hinges, and fix above a transom and $1\frac{1}{2}$-inch deal ovolo sashes hung on pivots with beads 1-foot 6 high; prepare the partition for these doors and sashes, and fix a similar door to obtain access to loft over closets; 1-inch strutting $4\frac{1}{2}$-inches wide to loft floor; mortice latches with bolt and horn knob, and fix round door rebated and beaded stops.

Fit up each closet with deal fittings as follows:—$1\frac{1}{4}$-inch fronts, clamped, and made to slide in 2-inch beaded grooved and framed uprights $2\frac{1}{2}$-inches wide, screwed to linings; $1\frac{1}{4}$-inch tongued seat with rounded edge, the seats to be rebated on three sides, and hung with $2\frac{1}{2}$-inch brass butts to a rebated and beaded frame $2\frac{1}{2}$-inches square, screwed to linings, the front edge throated to receive tongued edge of riser; the flaps and frame $1\frac{1}{4}$-inch, with rounded nosing and hollow tongued on; the frame beaded and the flap clamped with mortices and mitred clamps. Fix round $\frac{3}{4}$-inch deal moulded skirting 6-inches wide, with tongued angles and mitred returns; this and all skirtings connected with water-closets to be screwed on with brass screws. The flap and frame screwed to seat with four 3-inch brass screws and brass sockets made for the same. Fix a paper box and candle shelf. Two cisterns 66-inch by 36, and 30-inch inside, of $2\frac{1}{2}$-inch deal tongued and dovetailed; inch ledged covers with flaps hung with 18-inch garnets. Form flaps on the one-pair floor, as will be directed, to obtain access to pipes under, of the value of £3.

Fix on first floor, where directed, a sink 42-inch by 24, and 8-inches deep inside; the outer enclosure to go down to floor to form a closet, and to be rebated, having $1\frac{1}{2}$-inch square folding doors hung with $2\frac{1}{2}$-inch butt hinges, and fix to doors 6-inch bolt and brass knob turnbuckle. Fit up the eight water-closets in the two retiring rooms adjoining staircases, with $1\frac{1}{2}$-inch three-panel bead flush two sides doors, 30 in. by 78; $1\frac{1}{2}$-inch ovolo sashes over, 30 in. by 36, hung on pivots with beads, and fix lines, pulleys, and hooks to open and shut them, as well as all sashes hung on pivots; $1\frac{1}{2}$-inch linings rebated and staff beaded both edges; $3\frac{1}{2}$-inch butt hinges, and 5-in. mortice latches to each; line sides and ceilings of all, as before described. The eight fittings, candle shelves, and paper boxes to be the same as last described, but to be Spanish mahogany. The eight urinal closets in the same retiring rooms to be fitted up in the same manner as the eight water-closets. Fit up in each urinal closet a Spanish mahogany front, 2-feet 9 high, with door hung with $2\frac{1}{2}$-inch brass butts, and fix pulpit latch with horn knob; provide 20s. for fitting each urinal pan, in addition to the mahogany front provided; a mahogany candle shelf to each of these urinals. Provide and fix in these retiring rooms, water-closets, and urinal closets, eight cisterns, 4-feet by 3, and 2-feet 6 deep inside, of $2\frac{1}{2}$-inch deal, with ledged covers and flaps hung; fix over cistern on basement $1\frac{1}{4}$-inch deal ledged covers and flaps hung with garnet hinges. Form two doorways to obtain access to cistern rooms over water-closets and urinals in retiring room, ground floor, to be fitted with doors, fittings, and ironmongery, as described to water-closets, and fix skirting round them as before described.

Fix on basement story fifteen tier, on ground story twelve tier, on mezzanine story nine tier, on first story seven tier, and on second story six tier of pipe casing to soil, service, waste, and rain pipes; to be formed of flush beaded, grooved, and rebated grounds, 3 by $1\frac{1}{4}$, and 1-inch rebated and clamped panel, fixed with screws; cross rails every 3 feet 6 apart on the average; the flaps to be hung each with $1\frac{1}{2}$ pair of $2\frac{1}{2}$-inch brass butt hinges, and fix to each a brass knob turnbuckle; allow for one flap to each stack of pipe casing in each floor.

The doorways of the retiring rooms adjoining staircase on ground and mezzanine stories to have $2\frac{1}{2}$-inch wainscot four-panel moulded and bead flush doors 3 feet 4 by 7 feet 6, hung with $4\frac{1}{2}$-inch brass butts to wainscot frame 6 inches by $3\frac{1}{2}$, and fix round on the staircase side $1\frac{1}{4}$-inch wainscot tongued and staff beaded linings ten inches wide, and the same on room side, but to be deal. The window to ground-story room to be taken the same as one of the shop fronts in east area, and the window of the upper room to be like the other windows in east area in the mezzanine story, and fix inside of it $1\frac{1}{4}$-inch deal tongued, splayed, and staff beaded linings all round.

Fix in basement adjoining cistern a deal fitting for sink, the same as described for the upper story. The doorway to water-closet room on the second floor to have 2-inch deal bead flush two sides sash door 3-feet by 6-feet 10, hung with 4-inch butt hinges, to $1\frac{1}{2}$-inch deal rebated jamb linings, staff beaded one edge, rounded the other; and fix on room side $1\frac{1}{4}$-inch grounds 4 inches wide, and single architrave $3\frac{1}{2}$ inches girt. Fix round this room inch torus skirting 9-inch wide, and grounds for plaster. To perform all cutting and attendance upon plumber needful for the proper execution of his work. Fix narrow plaster grounds to all work connected with water-closets and urinals, so that any part of it may be removed without disturbing any adjoining work.

The contractor to provide and fix, in addition to what is herein shown and described to be done to Lloyd's rooms in connection with internal plumber's work, 350 feet superficial of inch rebated tongued and staff beaded linings and casings to pipes, in narrow widths, and 500 feet lineal of framed and grooved grounds $2\frac{1}{2}$ inches wide; besides additional fittings, to be hereafter directed, of the prime cost value of £100; and also, for extra pewter and glazed tile linings to urinal pans, the sum of £16 for prime-cost charges.

Royal-Exchange Assurance.—A water-closet and cistern, sink, and dresser in second floor; three water-closets one-pair, two water-closets in mezzanine story; two water-closets, one sink, and one dresser in the basement. Provide slate cistern in basement of the prime cost value of £10 with $1\frac{1}{4}$-inch ledged cover on bearers, and inch flap, hung with 30-inch garnet hinges. Fix over the double water-closet in basement a 2-inch deal one side cistern, 4 feet by 2 feet 6 by 2 deep inside, on two wrought bearers 4 inch by $2\frac{1}{2}$, inch ledged cover and flap, hung with 12-inch garnet hinges. Fix on floor over double water closet, one pair, a similar cistern and fittings, but to be 6 feet by 3 feet and 3 feet deep inside. Fix over water-closet under stairs on one pair, a cistern of 2-inch deal, one side, 3 feet by 3 by 2 feet 6, and two bearers and cover. To fix over double water-closet, one pair, and water-closet in second floor, a $2\frac{1}{2}$-inch one side deal cistern 6 feet by 3 feet 6, and 3 feet deep, with one $\frac{3}{4}$-inch bolt, and two straps, bolt covered with lead pipe, $1\frac{1}{4}$-inch ledged cover and flap, hung with 20-inch garnet hinges.

Fix in kitchen 2-inch deal sink 3 feet 6 by 2 feet, and 8 inches deep inside; the outside enclosure to go down to floor to form closet, rebated for $1\frac{1}{2}$-inch square folding doors, hung with $2\frac{1}{2}$-inch butt hinges, and fix 6-inch bolt and brass knob turnbuckle. Fix a sink and fittings as E in the basement.

Fix to the eight water-closets fittings as follows:—Six to be deal, and two to be Spanish mahogany; $1\frac{1}{4}$-inch fronts, clamped and made to slide in 2-inch beaded and grooved uprights, $2\frac{1}{2}$-inches wide screwed to linings; $1\frac{1}{4}$-inch tongued seats, with rounded edges; the seats to be rebated on three sides, and hung with $2\frac{1}{2}$-inch brass butts, to a rebated and beaded deal frame $2\frac{1}{2}$-inches square, screwed to linings, the front edge throated to fit tongued edge or riser. The flaps and frame $1\frac{1}{4}$-inch with rounded nosings, and

hollow tongued on; the frame beaded and the flap clamped with morticed and mitred clamps. Fix round $\frac{3}{4}$-inch moulded skirting 6 inches wide, with tongued angles and mitred returned ends; the flap hung with 3-inch brass butts, and frame screwed to seat with four 3-inch brass screws, and brass sockets made for the same; the skirting screwed to lining with brass screws; cut holes for seat, rounded, and holes for handles, with beads mitred round. Fix in each a paper box and candle shelf, part deal and part mahogany.

Fix in basement four tier, in the ground story four tier, in the mezzanine story three tier, in the one-pair two tier of pipe casings, formed of rebated and double flush beaded and grooved grounds, 3-inches by $1\frac{1}{4}$, and inch rebated and clamped panels 14 inches wide on the average, fixed with screws; three cross rails to each stack in each story, and allow for hanging one panel in each story in every stack, with one-and-half pair of $2\frac{1}{2}$-inch brass butt hinges, and fix to it a brass knob turnbuckle. Provide also for 250 feet superficial of inch rebated, tongued, and staff beaded pipe casing in narrow widths, and 400 feet lineal of framed and grooved grounds $2\frac{1}{2}$ inches wide. Provide for all cutting for pipes, including cutting through arches.

Line the ceiling of water-closet, two-pair story, and sides round seats the whole height, and the remainder of sides 4 feet high, to top of ground, with $\frac{5}{8}$-inch matched and beaded linings out of battens, the edges rebated, and fix $1\frac{1}{4}$-inch rebated and beaded grounds all round for the same, top and bottom $3\frac{1}{2}$ inches wide, and the edges of the grounds adjoining plastering to be extra rebated and grooved. The door to be $1\frac{1}{2}$-inch, two-panel, bead flush, and square, 2 feet 3 by 6 feet 6, hung with 3-inch butt hinges to $1\frac{1}{2}$-inch jamb linings, single rebated and staff beaded, two edges, and fix to door a bow spring latch, and a 4-inch brass bolt. Fix in window deal cased frame, oak sunk sill, and $1\frac{1}{2}$-inch ovolo sashes, double hung, and brass axle pullies, patent lines, and sash fastenings. Fix round inside inch tongued splayed staff-beaded and grooved linings, and $1\frac{1}{4}$-inch window board, rounded and tongued. Fix in kitchen a dresser of the prime-cost value of £5, and chimney shelf and brackets, and plate-rack, and sundry other fittings, of the value collectively, of £3 prime cost. Fix, to ascend to water-closets one-pair, $1\frac{1}{4}$-inch moulded steps and risers, housed to $1\frac{1}{2}$-inch keyed spandril, flush beaded, and grooved on the top edge, and staff beaded on edges next passage. The floor over to extend over lobby and two closets only, and form three openings in the same 2 feet by 1, and fix round them $1\frac{1}{4}$-inch rebated, staff beaded, and grooved linings, fixed on splay 4 inches all round, and the opening glazed with unground plate glass level with floor. The ceiling of lobby and two closets finished as before described. Form the closets with 4-inch quartering, bricknogged on edge, and trimmed for two doors 2 feet 6 by 6 feet 10, and two openings at back of seats 18 in. by 12; the doors $1\frac{1}{2}$-inch three-panel bead flush and square, hung with $3\frac{1}{2}$-inch brass butts to $1\frac{1}{2}$-inch jamb linings, rebated and staff beaded two edges, with a 5-inch two bolt mortice latch to each. Fill in small openings with eight $\frac{3}{4}$-inch louvers 6 inches wide, housed both ends into $1\frac{1}{2}$-inch similar linings. The backs and remaining sides of closets and lobby to be lined with $\frac{5}{8}$-inch linings and grounds, as before described; the cistern will stand on floor over.

Enclose water-closet under stairs with similar 4-inch partition, door, and fittings; the ceiling and sides lined. Provide for this closet a ventilating shaft 6 inches square inside, to pass through ceiling and stairs, and along ceiling of two-pair, out through curb. Provide also for fixing a 9-inch illuminator in one of the windows of staircase over this closet.

Provide and fix similar partition and doors, and provide similar linings to sides and ceiling of the two water-closets in mezzanine story; 2 feet 2 of the ceiling will be open, and the upper panels of the doors to be glazed with ground glass. Fix round lobby $1\frac{1}{4}$-inch flush beaded and grooved plinth 9 inches high; stucco sides, and lath plaster and float ceiling. The door from staircase to this lobby to be a $2\frac{1}{2}$-inch deal four-panel moulded and bead flush door 3 feet 2 by 7 feet, hung with one and half pair 4-inch butts to 2-inch three-panel bead flush jamb linings, rebated and staff beaded both edges, and fix to it a 7-inch three-bolt mortice lock with buffalo horn furniture.

Fix similar partitions, doors, linings, bow latches, and bolts to sides, but not ceilings, of water-closets in basement, and allow 5*l.* for prime-cost charge for providing a shaft for light and ventilation from Ambulatory; the opening for doorway to be 8 feet high, but the doors 6 feet only. Fix in doorway leading to lobby $1\frac{1}{2}$-inch four-panel bead flush and square door 6 feet 6 by 3 feet, hung with $3\frac{1}{4}$-inch butts, and a 7-inch rim lock, to $1\frac{1}{2}$ inch keyed jamb linings to sides only, on eight wood bricks rebated and rounded both edges. Provide in one room in basement dresser and fittings, similar to those provided for kitchen in second floor.

Provide for executing sundry extra works connected with water-closets, &c., of these offices, as will be directed by the architect, to the extent in prime-cost value of 25*l.*

London Assurance Offices: One and Two-Pair Stories.—One water-closet and one cistern on one pair; four water-closets, three cisterns, and one sink on two-pair; one slate cistern, and one sink in basement.

The water-closet room on two pair is to be fitted up in every respect as the room in Lloyd's, including sash door, skirting, loft over closets, partition to water-closets, and two cisterns. Fit up water-closet, one-pair, with cistern of 2-inch deal one side, 3 feet by 3 by 2 feet 6, and two bearers and cover. The whole of ceiling and the sides round seat only to be lined as before described; the remaining sides to have torus plinth and grounds. The water-closet, one-pair story, to have a floor over, with joists, and plates 4-inches by $2\frac{1}{2}$, and three iron bearers; and lay $1\frac{1}{4}$-inch flooring with small door 3 feet by 6 from passage, and skirting round, $4\frac{1}{4}$-inches wide. The entrance doors to be $1\frac{1}{2}$-inch, four-panel, bead flush, two sides, $3\frac{1}{2}$-inch butt hinges, mortice latch and bolt to lower door; 6-inch dead lock to upper door; $1\frac{1}{2}$-inch rebated linings, staff beaded two edges. Allow 5*l.* for skylight in loft and shaft, to light this closet and loft. Fix slate cistern of the prime-cost value of 10*l.*, and one sink and fittings complete in basement.

Fix in basement six tier, on ground story eight tier, in mezzanine eight tier, in one-pair, eight tier, and in two-pair four tier, of pipe casing and grounds, as before described; and allow for 250 feet superficial of inch pipe casing, and 400 feet run of grounds, as before described.

The contractor to execute sundry extra joiner's work connected with water-closets, and internal fittings, to the extent of 15*l.* in value.

Unappropriated Offices, One and Two-Pair of North-west Angle.—One slate cistern, and one sink in basement, under stairs; two water-closets and urinals, and two cisterns, one pair; one cistern, and one sink, in two-pair.

Fit up sink and closet complete in porter's room, second story; the water-closet and urinal to be nine feet high, and to have a floor over, $1\frac{1}{4}$-inch floor on joists 4 by $2\frac{1}{2}$; bearers all round, except one side, 4 by 3, spiked to partition; six iron bearers 28lbs. each. An entrance to this loft from small staircase, with door 2 feet 6 by 6 feet 6, $1\frac{1}{2}$-inch four-panel square, hung with $3\frac{1}{2}$-inch butt hinges, and 6-inch dead lock; $1\frac{1}{2}$-inch jamb linings; the sides to be skirted. The entrance doors to water-closets one-pair to be 3 feet by 7 feet, 2-inch, four-panel, wainscot, bead flush, and moulded door, circular on plan; $1\frac{1}{2}$-inch deal jamb linings, rebated and staff beaded; 4-inch brass butts, and mortice latch, with four keys. The whole of the sides and ceiling boarded as before described. The windows will be described with the other windows, but will be fitted up inside with plain $1\frac{1}{4}$-inch tongued and staff beaded linings. The partitions, doors, and sashes over doors, to be as described to water-closets in second floor of Lloyd's rooms: there is to be no enclosure to urinal. Make fittings, paper box, and candle shelf to water-closets, and mahogany fitting, and similar provision for extra work to urinal.

One cistern in two-pair, 3 feet 3 by 2 feet 6; 2-inch deal, one side, dovetailed, on wrought bearers, with inch ledged top, and flap hung with 14-inch cross garnets. Two cisterns in loft over closet, 5 feet 6 by 3 feet by 2 feet 6, of $2\frac{1}{2}$-inch deal one side, with $1\frac{1}{4}$-inch ledged covers, and flaps hung.

Fix in basement three tier, ground story four tier, mezzanine four tier, one-pair three tier, and two-pair one tier, of pipe casing and grounds, and provide for 150 feet superficial of 1-inch pipe casing, and 250 feet run of grounds, as before directed.

The contractor to execute extra joiner's work connected with the water-closets in these offices, to the extent in value of 15*l.*

All cisterns in these and other offices and places to be dovetailed at the angles, the bottoms tongued, and the joints glued and feather-tongued, and fix fillets at angles; and cut all holes for pipes and boxes.

Banking-house, North-west Angle.—One closet and cistern in mezzanine story; one cistern and sink in scullery; one dresser in kitchen; three

water-closets; one cistern over them; one slate cistern and one sink in basement; one dresser in kitchen.

Enclose upper water-closet with 2½-inch deal framed partition, prepared for door, and sash door, 2 feet 6 by 6 feet 8, 2-inch four panel moulded and bead flush, with beaded stops, and architrave 6 inches girt, round on staircase side; 4-inch butt hinges, mortice lock. The sash 2 feet 6 by 4 feet 6, 2-inch moulded with margin bars, glazed with ground glass, and allow 35s. for extra metal ventilator and casement; moulding round sash as to door, and 1¼-inch torus plinth 9 inches high on both sides of partition. Mahogany fitting to closet, including paper box and candle shelf. Above fix a cistern 3 ft. 6 by 2 ft. 6 by 2 ft. deep inside, fixed 18 inches below ceiling, to be 2-inch deal one side, on wrought and framed bearers. Case the front and soffit with 1¼-inch bead flush framing, and one door hung with 2½-inch butt hinges, and a turnbuckle on the same. Fix framed grounds on ceilings and walls for plastering, and to fix casings. Fix to back and sides of seat, linings as before described. Fix to remainder of closet 1¼-inch torus plinth and grounds.

Fix in scullery a cistern, 5 ft. by 3 ft. by 2 ft. 6, of 2½-inch deal one side, with no casing; inch ledged cover and flap, hung with 14-inch cross garnets; wrought and framed bearers. Fix sash and fitting as described before.

Fix in kitchen a dresser, of the prime cost value of 5*l.*; chimney shelf, and brackets and plate rack, together of the value of 3*l.* prime cost.

Fit up water-closet in basement with 2-inch square framed partitions, and 1½-inch three-panel bead flush and square door; upper panels filled in with second glass, hung with 3½-inch butt hinges, with beaded stops round, bow spring latches, and 6-inch bolts. Fix over closets a cistern as last, complete. Deal fittings, paper boxes, and candle shelves; no linings to ceilings, but linings to backs and brick sides as wide as seats, 4 feet high above seats. Similar linings to the brick sides, 4 ft. from floor; this lining to be the ¾-inch lining with grounds. Fix, on north-west angle of kitchen, slate cistern like the others. Fix in kitchen adjoining cistern a sink and fittings complete; fix in kitchen a dresser, and the same fittings as described to scullery and kitchen in mezzanine story.

Fix in basement five tier, ground story two tier, and mezzanine two tier of pipe casing and grounds, and allow in addition 100 superficial of pipe casing, and 200 feet run of grounds.

The contractor to execute extra joiner's work for the water-closets connected with this department of offices, to the extent in value of 10*l.* prime cost.

Shops.—Fix in thirty-six basements of shops, fittings as follows:—The partitions to be from floor to ceiling, 9 feet high, and of 2-inch square framing, prepared and rebated for a door and sash. The doors to be 2 ft. 3 by 6 ft. 6; 1½-inch three panel square, hung with 3½-inch butt hinges, and a bow spring latch, and 6-inch bolt to each. A sash to each partition, 2 ft. by 1 ft. 6; 1½-inch ovolo glazed; beaded stop round door and sash. The brick sides in closets only to be lined 4 feet high, with linings and grounds, as before described. Deal fitting, paper box, and candle shelf complete. A cistern 3 ft. by 3, and 2 ft. 6 in. deep inside, adjoining to water-closet; 2-inch deal dovetailed, one side, with inch ledged cover and flap, hung with 14-inch cross garnets. Oak bearers and uprights 4 by 4, studded into stone. Fix under cistern a sink 3 ft. by 1 ft. 9, and 6 inches deep inside, fitted up as in the other kitchens.

The contractor to execute extra works connected with these water-closets to the extent of 25s. each.

The whole of the mahogany work connected with all the water-closets and fittings in each set of offices to be French polished; and it is to be covered, preserved, and delivered up, together with all other works, in clean and perfect condition.

Skirtings, Wall Linings, and Sundries.

Two-Pair Floor: Royal-Exchange Assurance.—Fix round kitchen and room adjoining dwarf linings as described round shops. Fix to every other part 1¼-inch torus plinth 9 inches wide, and narrow grooved grounds for plaster; beaded angle staves to all external angles. Fix round circular opening in passage floor, *i. e.* the circular part, 1¼-inch tongued, staff beaded, and sunk apron with moulded nosing and hollow; the whole to make 14 inches; 1¼-inch deal balusters, and wainscot handrails 3 in. by 2¼; four iron balusters: mitred returns to skirting where needful.

London Assurance.—The mastic flush beaded skirting of staircase to finish with stone landings, and fix to the remainder of long passage 1¼-inch flush beaded plinth, grooved for stucco 9 inches high. Fix to every other part not before taken 1½-inch torus plinth, and grounds 9 inches high beaded angle staves. To form two openings in floor under flat lights; fix round them 1¼-inch staff beaded and sunk linings 10 inches wide, and 2½-inch moulded wainscot frame, rebated for eight squares of rough plate glass, ground on upper surface, to be fixed flush with floor. Fix in small opening one, and in larger opening five brass rebated and moulded bars to bear the glass; the glass to have ground edges, fitted in close rebates with strong cement. Fix to jambs of small arched opening in partition 1½-inch linings up to springing, staff beaded both edges, and take bracketting for arched soffit.

Lloyd's Room.—One inch and quarter torus skirting 9 inches wide, and plaster grounds to all parts not otherwise described: and fix all angle staves wanted.

Unappropriated Offices.—One inch and quarter torus plinths and beaded angle staves.

N.B. The sides of water-closets, and other places connected with them in this and other floors, will be lined in part, and partly skirted; and all such works are to be done as they are described in that part of the specification of joiner's work which relates to the water-closets, and rooms, places, and parts adjoining.

One-Pair Floor: Royal-Exchange Assurance.—Beaded angle staves to all external angles; eight deal pilasters in passages 10 feet 6 from floor; skirting to mitre round; the pilasters to be glued, blocked, and mitred, with narrow returns fixed to skeleton grounds; moulded caps mitred 10 inches girt. Fix all round passage 1¼-inch flush beaded skirting 9 inches high, grooved for stucco, to match mastic plinth on stone landings. Fix round three waiting-rooms, secretary's rooms, actuary's, and governor's two rooms, but not closet, and porter's room, dado complete 3 feet high, *i. e.* inch plinth 6 inches high rebated, base moulding 4 inches girt, 1¼-inch keyed dado 2 feet 6 high, rebated both edges, two tier of backings, moulded

C { surbase 8 inches girt, grounds for plaster. To fix round Life and Shipping offices 1½-inch bead flush dwarf wainscoting, narrow panels, and frieze panels; 1¼-inch flush beaded and rebated plinth 6 inches high; 1¼-inch grooved, rebated, and flush beaded grounds 5½ inches wide, moulded surbase 6½ inches girt, the whole 4 feet 6 high, continued over chimney pieces. }

Take in court and committee rooms dado as before described, but to be of wainscot; housings, tongued angles, some mitred, some staff-beaded; line closet in governor's room with matched linings 9 feet high, and form ceiling with boarding and joists 4 in. by 2½. Allow £5 for fitting up closet over.

London Assurance.—Fit up with wainscot dado, like the last, three rooms, for the court governors, and committee. The passage and small room, deal flush beaded skirting. Committee room in circular corner, dado, but deal as described to the Royal-Exchange Assurance. Four offices to have deal wainscotting as described and included in bracket C, above. Angle beads, no pilasters, but bracket out for piers, and fix angle beads. Fix in secretary's room a sash with semi head of 2½-inch wainscot, to correspond with window in internal façade, glazed the same; one square to have metal casement, 1¼-inch wainscot, staff beaded, tongued, and grooved linings round.

Lloyd's Rooms.—To fix round the captains' room wainscot moulded plinth as follows:—inch keyed plinth 18 inches wide, base moulding 2½-inches girt, inch upper plinth, tongued 10 inches wide, and upper moulding 5 inches girt, all with proper deal grounds and backings. Fix round the two great rooms, the reading room, and the secretary's room, wainscot dado, part in short lengths, with narrow returns to form pedestals to piers, as follows:—Inch keyed plinth, base moulding 5 inches girt; inch key dado 1 ft. 7 wide, rebated both edges; moulded surbase 9 inches girt; two tier of deal grounds. All the plinths, including plinths of dados, to be tongued to floor in Lloyd's rooms; the angles to piers, &c. will be patent cement.

To fix round clerks' office in tower and passages adjoining, deal bead flush dwarf wainscotting, as described for offices on this floor; beaded angle staves in these rooms.

Unappropriated Offices.—Prepare and fix to entrance 1¼-inch deal plain pilasters, with narrow returns and angles glued and blocked, with moulded and mitred plinths and caps, on 1½-inch skeleton grounds. To fix round board room and committee room wainscot dado complete, with deal grounds, as is described for the court room of the Royal Exchange Assurance offices. To fix round all the other rooms deal dwarf wainscotting, framed bead flush, and all fittings complete, as is described for the Shipping and Life offices of the Royal-Exchange Assurance offices. To fix to the passages 1¼-inch flush beaded plinth, as before described, to match the mastic plinths on staircases and landings. Fix all beaded angle staves.

Ground Floor: Royal-Exchange Assurance.—To fix round great office and recess 1¼-inch bead flush wainscotting with frieze panels, the panels not more than 9 inches wide, inch flush beaded plinth 7 inches wide, 1¼ inch beaded ground 4 inches wide, and moulded surbase 5 inches girt, the wainscotting rebated top and bottom; the plinth and ground rebated, and the ground grooved for plastering; the whole 4 feet 6 high; internal angles tongued, external angles rebated and staff beaded. The wainscotting to be continued under the two small windows, but not the two large windows, and to be continued over chimney-pieces; the capping to be housed to architrave of door, and returned and mitred to linings of two windows; three tier of backings fixed to wall with holdfasts; beaded angle staves to external angles.

Thirty-eight Shops, and Recesses in them.—To fix round every part matched and beaded linings, with flush beaded plinth, capping, and ground, the whole to be four feet high; the linings of two cut batten stuff, rebated both edges; the plinth 1¼-inch, 7 inches high, rebated and beaded; the grounds 2 inch by 1¼, rebated, beaded, and grooved; tongued angles to plinth, which is also to be tongued into linings round reveals of shop fronts; rebated and staff beaded external angles to linings; one tier of backings as last to linings; linings to be taken all round staircases, and round all piers and recesses, and to be housed into shop fronts in six small shops in east area, and to continue in reveals of two outer doorways to small shops adjoining east entrance, housed into frames, continued across all flues, and made good to upright slabs 2 feet by 3 high, which will be fixed against walls; beaded angle staves to all external angles.

Banking-house.—To fix round bank only wainscotting complete, similar to that which has been described to office opposite. To fix round the two private offices 1¼-inch keyed dado; two sets of grounds; 1¼-inch moulded base 7 inches high, and surbase 6 inches girt, the whole finished 3 feet 3 high; not to be continued through windows, but to be return-mitred to the linings, and to be housed to architrave of doorways.

Mezzanine Floor: Royal-Exchange Assurance.—To fix round treasury, lobby of water-closets, and accountant's room, wainscotting with plinth, surbase, grounds, and backings, as in office below, excepting that the whole is to be 3 feet 9 high, and the wainscotting one panel high only; to be housed to architraves of doors, with beaded angle staves to external angles; the wainscotting not to be continued across window backs.

Thirty-six Rooms with Recesses over Shops.—Fix round every part including window linings, and in window backs, inch torus plinth 9 inches wide, with backings and narrow grooved grounds for plaster; tongued angles to plinth; beaded angle staves to all external angles.

Banking-house.—To fix round kitchen and scullery wall linings, plinth, grounds, and backings, as described to the thirty-eight shops. To fix round sitting room 1¼-inch rebated plinth, 9 inches wide and backings, narrow grooved grounds, and base moulding 4 inches girt, not to be continued through window backs. To fix in passage and three chambers, torus plinth, grounds, &c., as described to the thirty-six rooms over shops; all plinths to have tongued angles, and to be housed to architraves round doors; beaded angle staves to all external angles. Deal grooved grounds and proper deal backings to be taken in all cases to all moulded or beaded plinths, and all dados, wainscottings, dwarf linings, pilasters, and other work; all grounds and backings to be plugged; all mouldings, and all plinths, dados, wainscottings, and dwarf linings to be housed wherever they abut, to be scribed to floors, and all stone work or marble work adjoining them; all internal angles to be tongued, and all external angles to be mitred and tongued, except in some cases in which the external angles will be rebated and staff beaded; all angles of pilasters and caps, and bases to pilasters to be mitred glued, and blocked; all grounds to be framed at the angles, and all grounds in sight to be mitred and tongued; the plinths to be ramped where needful; all grounds, wainscottings, dados, linings, plinths, and pilasters are to be grooved where required for plastering, and rebated for mouldings.

The contractor to provide and execute extra joiner's work as follows, according to future directions to be given by the architect:

To Lloyd's rooms to the extent in value of £250. To the offices of the Royal-Exchange Assurance to the extent in value of £150. To the offices of the London Assurance to the extent of £100. To the Banking-house offices to the extent of £25. To the unappropriated offices to the extent of £50.

Fix in ceiling of large lobby and recess seven frames for horizontal lights; six of them 5 in. by 4, and one 6 in. by 6, of fir, moulded, rebated, and grooved. Fix in frame metal ornamental sash glazed of the value of £12. Fix in the other frames sheets of ground glass. The plans of all these lights are shown in drawings XVIII. and XIX.

Washing-Room on Second Floor.—Fix round openings for skylights similar linings and mouldings to those described for the openings under skylights of the Royal-Exchange Assurance. Fix similar linings and mouldings to two openings in ceiling floor in room beyond tower.

One-pair Story.—Fix to the thirty-nine large windows of the external façades in the one-pair story, six of which are circular on plan, frames and sashes as follows:—Strong deal cased double frames with transoms, and 2¼-inch astragal and hollow wainscot sashes; two upper sashes fixed, the two lower pair hung double, with catgut lines, brass axle pulleys, and lead weights; best patent sash fastenings, oak sunk sills, 9 inches wide, and 4-inch copper tongue to oak and stone sill; inside wainscot beads 1½-inch wide, fixed with brass screws and sockets; 1¼-inch wainscot pulley styles; 1¼-inch outside, and 1-inch inside linings, with wainscot edges. Fix on muntin and transom wainscot moulding, 6 inches girt, and on sides and head of frame wainscot moulding 2½ inches, mitred. These mouldings fixed on with tongues.

Fix to the twenty-four windows in the internal façades of the one-pair story, frames and sashes as follows:—Strong deal cased frames, with wainscot beads and pulley-styles, and oak sunk and grooved sills; copper tongue to oak and stone sills; 2½-inch wainscot astragal and hollow sashes, glazed, six of them with polished sheet glass, and fourteen with polished plate glass, double hung, catgut lines, large brass axle pulleys, lead weights, 1¼-inch outside linings, 1-inch inside ditto, 1½-inch pulley styles; inside bead 1¾-inch wide, fixed with brass screws with sockets, heads finished circular. The four smaller windows sheet glass.

Economy of Fuel.—Any new invention, which is stated by competent judges to be capable of effecting a great saving of fuel, and an almost total consumption of smoke, has claims on the public attention and investigation. Such an invention, we are assured, is the steam-boiler furnace of Mr. H. F. Baker, of Boston, United States. Soon after its introduction into this country, Mr. Wicksteed, civil engineer, at the request of the patentee's agent, made two long experiments upon three Cornish boilers: first, without the new furnace; and secondly, the same boilers with the new furnace, using small Newcastle coals of inferior quality. From his details and results of these experiments we select a few, which seem to exhibit great superiority in regard to the saving of fuel and the efficiency of action:—

	Without new furnace. lb.	With new furnace lb.
Coals consumed per hour … … …	313	293
Water evaporated per hour … … …	2.170	2.256
Do. per lb. of coals from initial temperature	6.919	7.701
Do. from 212 deg. (latent heat 1,000 deg.) …	7.725	8.640

The last line shows that, when taking the coals from the heap, 1lb of coals

with this furnace exaporated 11.8 per cent. more water than without. Mr. Wicksteed adds, that "After this trial, which exhibits a saving of 11 8-10 per cent. of fuel in the Cornish boilers, I can have no hesitation in declaring that the saving of 37 per cent. upon the average, stated to have been effected in the American establishments, has been effected, and that there are numberless cases in Great Britain where a similar saving might be produced. Mr. Wicksteed says he had not a fair opportunity of testing the merits of this furnace as a smoke consumer, but with one straight flue to the chimney, as in the American furnaces, he thinks if a reduction of fuel were effected by introducing slow combustion generally, the average saving in our manufacturing establishment would be 30 per cent. of fuel; and that "this would cause an annual reduction of smoke in proportion to the fuel; but there is also no doubt that the reduction of black smoke evolved from the chimneys would be in a much greater proportion than the reduction in the quantity of coals, in consequence of the slow combustion." This furnace is said to have the further merits of cheapness of construction (causing a considerable saving in the first outlay upon new boilers and buildings), and of being cheaply adapted to any description of boiler already set. None of these furnaces being yet erected in Manchester, we are unable to say anything of our own knowledge respecting their merits, but we understand that there is one at the works of Messrs. Thomas Hoyle and Sons at Dukinfield, which gives great satisfaction both as to its economy of fuel and its consumption of smoke. Mr. Graham, of that firm, has stated, that the very careful experiments there made with this furnace, would indicate a better result than any he had ever before obtained from any of the furnaces which he had experimented upon, in numerous experiments on the evaporation of water and on smoke burning. Another of these furnaces is at work at the Broad Oak print works of Messrs. Hargreaves Brothers, at Accrington, and gives satisfaction there. We have seen a letter from the United States, which states that these furnaces are being erected at the Washington navy yard, under the direction of the engineer-in-chief of the United States' navy, and that they are also to be placed at the other navy yard (Norfolk, Virginia).—*Manchester Guardian.*

[The Mr. Baker referred to, is we believe, a professor at one of the American Universities. His new furnace is one with a direct draft, that is, without side flues, and with a number of bridges behind the furnace; so far there is nothing new, the same arrangement having been adopted in some of the English mills, and the only novelty to which Mr. Baker can lay claim, is the peculiar form of the fronts of these bridges, which are made of a certain curve (a parabolic, we believe) which is supposed to reflect a considerable quantity of heat against the boiler bottom. Its efficiency, as a smoke consumer, depends upon the reverberation of the flame against the heated fire brick bridges, a plan which was indicated in the *Artizan Treatise on the Steam Engine,* as the simplest way of arriving at such a desirable result.]

NOVELTIES.

Exportation of Machinery.—The return of the Board of Trade for the month ending the 5th of March show a lamentable deficiency in this article, as compared with the corresponding month in 1848, the falling-off being from £68,888 to £21,788. It is worthy of remark, however, as indicating that "there is a good time coming," that the total value of exports has increased from £3,597,842 to £4,018,938, being an increase of £421,096 over the corresponding month of last year, and of £572,631, as compared with March, 1847.

Roman Remains at Colchester.—Mr. J. Taylor, of West Lodge, has been very successful in his excavations on the site of the Roman burial ground, adjoining the Lexden-road. About 250 funereal vessels have been discovered, and a number of coins, none of which are of a later date than Hadrian. Some mirrors made of speculum metal still retain their powers of reflection, unimpaired by the damp and darkness of 1500 years. Mr. Taylor proposes to form a local museum, and we trust the Colchesterians may have public spirit enough to appreciate the gift, and provide a suitable building for the conservation of these interesting objects.

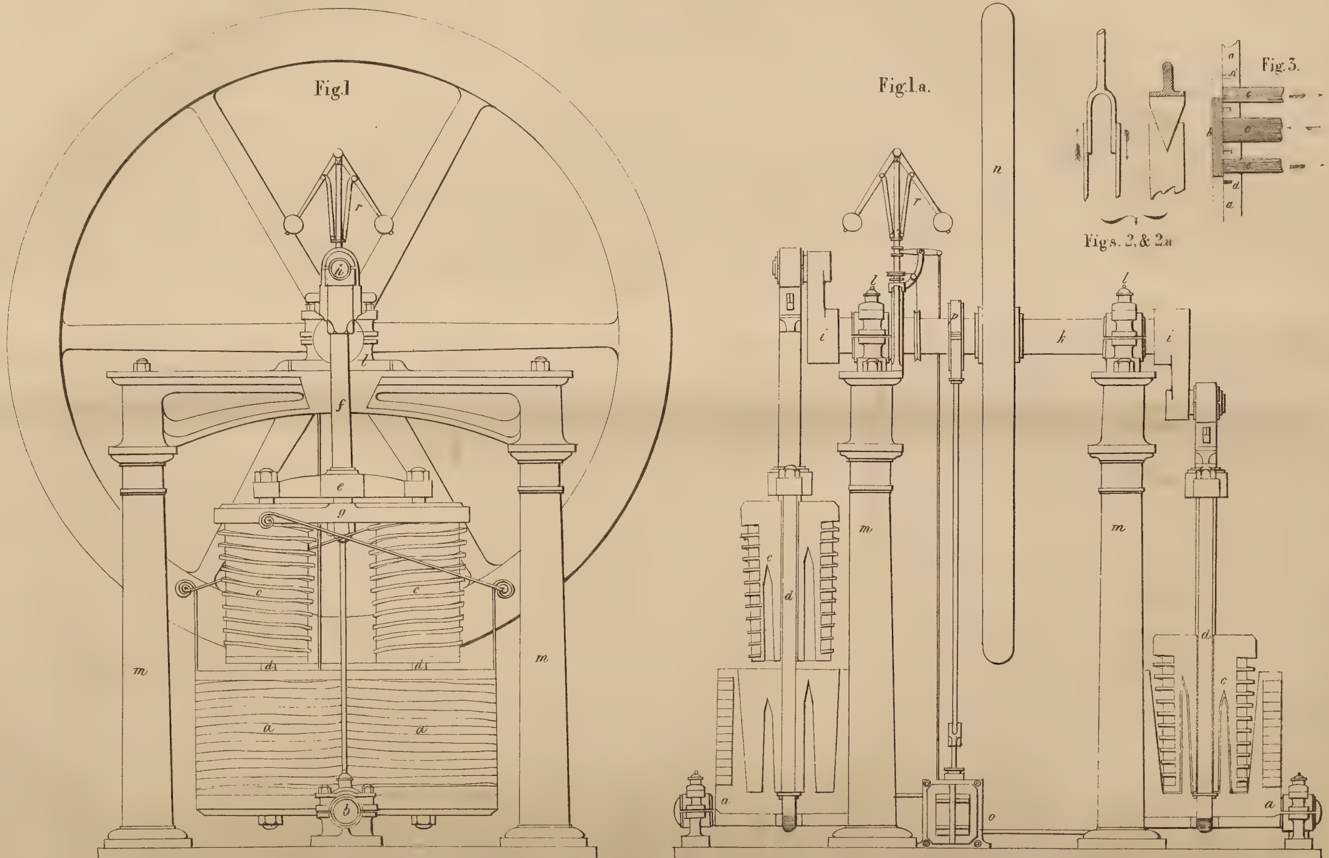
Profitable Use for Farringdon Market.—A portion of the market, next Shoe-lane, has been converted into a ragged school, and the remainder, for several years unoccupied, is proposed to be fitted up as a model lodging-house, and as public baths and wash-houses. This may be a useful hint to our provincial friends. We have noticed, in many places, public buildings which might be turned to like useful purposes.

Railways in Sweden.—A railway company has been formed for the construction of a line in Sweden, from Orebro to Hult, a distance of 51 miles. The Crown Prince is the patron of the company; Mr. Skogman, the president of the Board of Trade, is its chairman; and amongst the directors is Mr. Engström, the British Consul at Gottenburg. On reference to the map, it will be seen that the country, from the city of Stockholm on the Baltic across to Gottenburg on the North Sea, is intersected by three lakes, the largest of which is upwards of 80 miles long, and which, if united by a railway, would render practicable the conveyance of passengers and produce by steamboats and locomotives almost from one sea to the other. The estimated cost of the line now proposed is £270,000. A minimum dividend of 4 per cent. is to be guaranteed by the state for 15 years from the opening, accompanied by the following conditions:—1. No liability to reimburse the Government for the first 10 years, and then only out of half the profits, plus 6 per cent. 2. A title to the line in perpetuity. 3. No liability to a state purchase for the next 50 years, except at a bonus of 25 per cent. beyond a valuation of referees (one half of them to be nominated by the company). 4. A tariff to be fixed by referees (one half of them also to be nominated by the company). 5. Cession *gratis* of Crown lands on the line (a very considerable portion of the line); materials; the labour of the Crown corps of paupers, convicts, and troops, at reduced wages; remission of import duties on supplies for the line; and a certain exemption from the ordinary taxation of the kingdom. 6. Extra remuneration for the transport of the mails and troops. 7. The erection of an electric telegraph at the public expense. 8. No liability to caution money. The line, which will be a single one to commence with, will pass through the mining district, and it is estimated that the existing local traffic would pay 6 per cent.; but, as it would eventually form part of a grand trunk line from Stockholm to Gottenburg, a distance of 400 miles, the traffic and profits would be materially increased. On the completion of the whole line, the journey between London and the Swedish capital would be reduced from 10 days to 60 or 70 hours, and the route to St. Petersburg would also be proportionately abridged. Perhaps a still more important consequence would be, that the commerce of Sweden would be rendered, in a great measure, independent of the navigation of the Sound.

Use for the Pitch Lake of Trinidad.—An important communication has been made by Earl Dundonald to Lord Harris, governor of Trinidad, on the substitution of bitumen from the pitch lake of La Brea, in place of coal, to the extent of two-thirds of this fuel, for the generation of steam, in the manufacture of sugar, &c.; thus also restoring to the soil, in form of manure, the refuse of the cane fields now used for fuel. In a furnace, in which it has been successfully used, the bitumen, it appears, is poured into a recess, or pit, just below the fire-bars, leaving sufficient room for a rapid current of atmospheric air, and as it is decomposed, the dense smoke and gases are carried through the incandescent fuel, and go off in flame and great heat. Earl Dundonald has forwarded a plan of this furnace to the governor. The *Port of Spain Gazette* expresses a hope that the subject will attract the attention of the Royal Mail Steam Packet Company, whose intercolonial steamers consume a vast quantity of coal, conveyed at great cost from England to the several depôts, for the whole of which, under a proper adaptation of their furnaces, the pitch might prove a cheap and effectual substitute.

Boiler Explosion.—On the 24th inst., about 10.30 a.m. a tremendous explosion occurred at Key's Saw Mills, in Back Church Lane, Commercial Road East. The boiler house contained two cylindrical high pressure boilers, with hemispherical ends, only one of which was at work at the time. The boiler house was completely surrounded by the machine rooms on the one side, and a row of cottages on the other. The empty boiler being next to the machine rooms, seems to have prevented the explosion taking effect in that direction, for none of the machinery is injured. The whole force has been exerted on the outer walls of the boiler house and the cottages, which present a fearful appearance. The boiler split lengthways down the middle, and rose to a great height in the air, carrying with it a heavy tank placed over; this tank fortunately fell just clear of the saw frames in the mill house. One end of the boiler fell at the farther end of the premises in the yard, but a beam of wood falling on the counting-house broke in the roof and the top floor. The lower half of the boiler is nearly flattened out, while the upper half is blown into various pieces. The back walls of 6 or 7 cottages are swept away, the materials, in some cases, being projected through the front windows. Amidst such a complete wreck it is astonishing that none of the men on the premises were hurt, and only one person scalded and otherwise injured, in the cottages. An aged person is also said to have died of fright. Another man had his leg broken by a bar of iron in its fall. The cause of the explosion seems to have been a want of water in the boiler, but from the difficulty of getting at the remains of the plates amongst the ruins, it is hardly possible to form a correct opinion as yet. The engine was running at the time, and the safety valve had been tried by a person who was on the boiler a few minutes before the explosion took place. The pressure is stated not to have exceeded 30 lbs. per square inch.

HJORTH'S PATENT ELECTRO-MAGNETIC ENGINE.



THE ARTIZAN.

No. VI.—Fourth Series—JUNE 1st, 1849.

MECHANICAL ENGINEERING.

HJORTH'S PATENT ELECTRO-MAGNETIC ENGINE.

We have now the pleasure of giving our readers a full account of this interesting invention, which has overcome the principal difficulty in the application of electro-magnetic power. The question of economy will soon be settled by the trial of a large engine, which we noticed, page 96.

We now extract from the specification, which is not so verbose as such documents generally are:—"In the following specification, the word magnet, unless otherwise defined, is used generically to signify either a permanent magnet, or metal, or other substance, made magnetic by a current of electricity. My improvements in the use of electro-magnetism, and its application as a motive power for general purposes, relate to a mode of obtaining such power by the reciprocal or rotary motion of magnets or electro-magnets. My invention consists in obtaining such power by means of magnets or electro-magnets, both fixed and moveable, formed and arranged in such a way, that during the motion of the moveable magnet or magnets, separate points or parts of the surface of the moveable magnet or magnets, or metallic armature, or the poles of the several moveable magnets, shall be brought separately and successively to act upon, or be acted upon, by the separate points or parts of the surface or poles of the fixed magnet or magnets, or metallic armatures, and so that the attraction or repulsion of one point or part of the surface or pole shall be followed up by the attraction or repulsion of another point or part of the surface or pole, so that a rotary or reciprocal action may be obtained and sustained over a greater length of stroke or circuit than by the simple action of magnets or electro-magnets arranged in the ordinary manner. I will now proceed to illustrate my invention by describing some of the forms of apparatus by which it may be carried out. Figure 1 represents the elevation of an engine made on this principle, and fig. 1 *a*, a section of the same engine. *a a* is a horse-shoe formed hollow magnet, conical on the inside, coiled with copper or other wires, and suspended in such a way that it oscillates on the centre *b* with suitable bearings and plummer blocks as shown in drawing. In the interior of this magnet are fixed a number of conical rods of different lengths; *cc* is another horseshoe formed magnet, conical on the outside with apertures corresponding to the conical rods in the magnet *a a*, and likewise coiled with wire. This magnet moves on the guide-rods *d d*, which are connected together at the top by means of the crosshead *e*, and fastened at the bottom of the magnet *a a*. *f* is a connecting-rod fixed to the magnet, *c c*, in the centre *g*, and at the crank-pin *h*, by means of a strap or any of the usual methods; *i i* are cranks fixed on the shaft *k*, which works in bearing *l*, supported on the frame *m*; *n* is a fly-wheel fixed on the shaft *k*, *o* is the commutator to change the electric current as required, similar in its mode of working to the slide valve of a steam engine, and moved in a similar way by an eccentric *p*, and eccentric rod; the action of the engine may be reversed by the use of a supplemental eccentric. The governor *r* serves to regulate the proper supply of the electric current to the commutator *o*, as hereinafter described. The current, after being regulated by the governor, is introduced through the commutator into the helix of wires coiled round the magnet *a a*, and thence through the conducting wires to the helix or coil of wires surrounding the magnet *c c*, and thence through the conducting wires to the battery or by the reverse course, as may be found convenient.

As soon as the electric fluid from the batteries passes round the magnets, they exercise their power by a mutual attraction not only in the ordinary way, but in consequence of the magnets being so shaped, that the inside part of the outer magnet as well as the outside part of the inner magnet, forms angles with the direction of motion of the moving or working magnet, and at the same time, rods of different lengths presenting themselves at the poles of the respective magnets, the attractive power is sustained over the whole stroke by successive points and successive parts of the surfaces, being brought to act upon one another during the whole stroke; when the stroke in this manner has been made by one set of magnets, the current is changed, and the other set of magnets are made effective by the current passing round them in the same manner as before described. In order to prevent the current from being broken and also to check the momentum of the magnets, the slide in the commutator *o*, is made so long that it does not leave the conducting surface which communicates with one set of magnets until it has reached the other, communicating with the other set of magnets. By the arrangement above described, a reciprocating motion is obtained similar to the common oscillating steam engine; and it will be obvious that a motion may be obtained similar to that obtained by any of the various forms of steam engines by suitable adaptations of beams, rods, cranks, &c. Thus it may be carried

out as a single or a double action engine, as an ordinary beam engine, or as a direct action engine, according as it may be required, for stationary, locomotive, or marine purposes, and in all cases its form may be varied, according to the circumstances of the case.

Figs. 2 and 2*a* represent, on a larger scale, my apparatus for regulating the current; its action may be readily understood from the drawings, and I choose as the most convenient form a forked piece of metal, with two wedge-shaped prongs sliding along two parallel surfaces. The current from the battery passes, as indicated by the small arrows in the drawing, from one of the parallel surfaces through the wedge-shape fork to the opposite surface, and thence to the commutator, and the current will pass with greater or less intensity, according to the amount of the communicating surface given by the larger or smaller part of the wedge. The particular form is immaterial, so that taper pieces of metal are used, which, by the ordinary action of the governor may give greater or less communicating surface. My commutator is shown in figure 3 on a larger scale. This apparatus consists of three metal surfaces *c c c*, placed in a non-conducting medium such as wood *a a*. The metal surface or slide *b*, is shaped and moved in in such a way as to conduct the electric fluid according to the motion of the engine alternately from the centre surface, which is connected with the battery to either one of the other and outer surfaces, which are connected respectively with the coils of the two sets of magnets. I make the slide, *b*, sufficiently long to be always in contact with one or other of the surfaces connected with the magnet coils, and by the adjustment of this length, and of the eccentric, any required lead, as it is termed, in steam engines may be attained; *d d* is black lead, which may be let into the insulating medium to facilitate the conduction, and at the same time to act as an anti-friction. The whole apparatus or commutator may be inclosed in an air-tight box, with a glass lid or cover, the slide rod working through a stuffing-box. Where large batteries are required for producing a sufficient quantity of electricity to work powerful engines, a compound commutator or several commutators may be employed, each being connected with a certain number of cells and a certain number of coils. By this means the destruction of the conducting points of the commutator will be avoided. The governor may act so as entirely to detach one or more of the commutators, and so throw off the cells of the battery communicating with such commutator.

(To be continued.)

SPECIFICATION OF THE IRON STEAM-VESSEL, "MINERVA,"

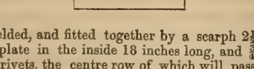
Of 627$\frac{9}{94}$ tons burthen, o.m., to be propelled by 2 engines of 400 horse power collectively.

HULL.—Length between perpendiculars	... ...	190 feet
Keel	... ...	182 "
Breadth, in way of paddle shaft	... ...	26 "
Over the sponsons	... ...	31 "
Depth amidships, from top of floors to under side of main deck at side of vessel	... ...	16 "
SHEAR OF DECK, forward	... ...	1 " 8 inches
" " aft	... ...	0 " 10 "

QUARTER-DECK.—To be 2 feet 6 inches high, and carried as far forward as the after bulkhead of the engine department. The hatch on the after hold to be on the quarter-deck.

TOP-GALLANT FORECASTLE.—To be same height as bulwarks, having the main rail to form a covering board, the dimension to be as agreed upon.

KEEL.—To be 8 inches wide, 4 inches deep, and 1 inch thick, made of iron rolled thus—



to be flush on the outside of the joints, the pieces to be as long as can be welded, and fitted together by a scarph $2\frac{1}{2}$ inches long, and united by a plate in the inside 18 inches long, and $\frac{3}{4}$ thick, with 7 rows of 1 inch rivets, the centre row of which will pass through both the keel plates.

STEM POST.—To be formed of a bar of wrought iron 6 inches wide, with an average thickness of $2\frac{1}{2}$ inches, kneed at the lower end, and running into the keel 3 feet, to which it is to be rivetted with 5 rows of 1 inch rivets. From the water line to the deck, the stem will be carried up in the form of an apron, made of $\frac{5}{8}$ inch plates, secured to the side plates by a frame of angle iron, having 2 rows of rivets.

CUTWATER.—To be formed of a bar of wrought iron 6 inches wide, and 2 inches thick, scarphed or welded to the main stem post. These bars to be recessed to receive the ends of the plates, which must be rivetted to the bar forming the cutwater by a single row, and to the stem post by a double row of 1 inch rivets. The cutwater to be formed to receive an appropriate figure head.

STERN POST.—To be formed of a bar of iron $5\frac{1}{2} \times 3$ inches at the transom, and worked down to 7×2 inches, at the keel, to be kneed in a similar manner to the stem post, and rivetted to plates by a double row of 1 inch rivets; projections to be left on the stern post to receive the rudder pins, and a heel 4 inches deep to bear the whole weight of the rudder.

RUDDER TRUNK.—To be of $\frac{7}{16}$ inch plates, 10 inches diameter, formed and connected with the stern post.

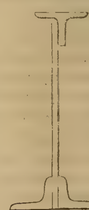
PLATES.—To be best Staffordshire or Shropshire iron, overlapped on the longitudinal joints, and double rivetted as far as lightwater mark on bilges; the butts of the bottom plates to have a strip 6 inches wide in the inside, with a double row of rivets on each side the seam; remaining joints to be flush, having a strip $4\frac{1}{2}$ inches wide in the inside, and a single row of rivets on each side of the seam; rivet-holes to be countersunk outside, and heads of rivets laid up inside. Slice or wedge pieces of wrought iron, and to be fitted into the interstices between the back of the frame and the flooring, and the outside plating before the plates are rivetted to them; no filling pieces to be allowed in any of the seams or butts.

GARBOARD STREAKS.—For 80 feet in midships, to be $\frac{3}{4}$ inch thick, and

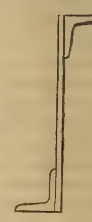
to taper them thence forward and aft to	... ...	$\frac{1}{2}$ inch
Bottom for 90 feet amidships	... ...	$\frac{5}{8}$ "
Remainder of bottom forward	... ...	$\frac{1}{2}$ "
" " aft	... ...	$\frac{7}{16}$ "
Bilge for 90 feet amidships	... ...	$\frac{9}{16}$ "
Sides up to 10 feet water mark	... ...	$\frac{1}{2}$ "
Remainder of sides for 90 feet amidships	... ...	$\frac{7}{16}$ "
Bows	... ...	$\frac{7}{16}$ "
To way of hawse holes	... ...	$\frac{1}{2}$ "
Stern quarters and stern	... ...	$\frac{3}{8}$ "
Cutwater	... ...	$\frac{5}{16}$ "

FRAME ROOM AND SPACE ROOM AND SPACE.—15 inches apart for 60 feet amidships, and then to be gradually increased to 2 feet forward and aft.

FLOORS.—For 70 feet amidships to be formed of 2 bars of angle iron 3 inches $\times$ $3\frac{1}{2}$, placed back to back, extending up the bilges to about 3 feet 6 inches from flat of bottom, and well fitted and rivetted to the shell between them, and to be inserted strips 18 inches $\times$ $\frac{7}{16}$ inch, to the top of which to be ┬ iron, thus:—



The remainder of flooring to be attached to the shell by single angle iron, the strips reduced to $\frac{3}{8}$ inch thick, and top finished with angle iron 4 inches $\times$ 4 inches $\times$ $\frac{3}{8}$ inch, thus—



SIDE FRAMES.—For 70 feet amidships to be of Messrs. Kennedy and Vernon's patent iron, 4 in. $\times$ 3 in. $\times$ $\frac{3}{8}$ in. to overlap the bottom angle iron of floors of bilge about 3 feet.

Bulkheads.—One to be at each end of the engine-room, one near the bow, and one near the stern, carried up only to the cabin floor. These bulkheads to be perfectly water-tight, and made of plates $\frac{5}{16}$ thick at the lower part, and $\frac{1}{4}$ inch thick at the upper part. To be stiffened by vertical bars of Messrs. Kennedy and Vernon's patent iron, 4 inches × 3 inches × $\frac{3}{8}$ inch. The angle iron to secure the bulkheads to shell of vessel to be 4 inches × 4 inches × $\frac{3}{8}$ inch, having double row of rivets in the outer shell, and not more than 6 to the lineal foot.

Rivets.—Rivets for keel 1 inch diameter, for bottom and bilge where double rivetted $\frac{3}{4}$ inch diameter, and 8 to each lineal foot; for remainder of shell, where single rivetted, $\frac{11}{16}$ inch diameter, and 7 to each lineal foot on each side the seam; for attaching the frames to the shell, rivets to be $\frac{3}{4}$ inch diameter and not more than 4 inches apart. Bulkhead rivets to be $\frac{5}{8}$ inch diameter with 7 to each lineal foot.

Keelsons.—To be of iron, five in number, made in the box form, and to run as far fore and aft as the form of vessel will admit. The centre keelson to be 12 inches square, engine keelsons to be 14 inches broad and about 12 inches deep, formed of angle iron 3 in. × 3 in. × $\frac{3}{8}$ in. thick, the bottom to be left open; to be firmly rivetted to the angle, and ⊤ iron forming the keelsons, and the plating of their sides under the engines to be increased to $\frac{1}{2}$ inch thick

Stringers.—To be of iron, and to run entirely round the vessel, and to be placed horizontally on the level of the lower deck, 12 in. × $\frac{3}{8}$ in. well secured to the side frames by angle iron 3 in. × 3 in. × $\frac{3}{8}$ in. thick. In the engine-room, this stringer to project 6 inches from the sides, and to be composed of two bars of Z iron with two outside flanges united by a strip $\frac{7}{16}$ inch thick. Another stringer, 18 in. × $\frac{3}{8}$ in. at main deck, and 12 inches × $\frac{5}{16}$ inch at quarter deck, to be placed horizontally underneath the covering-boards, and to the top of each deck beam right round the vessel.

Paddle-Boxes.—To be formed of angle iron 4 in. × 4 in. × $\frac{1}{2}$ in. to which the timber-planking, forming the tops and fore and after end, is to be secured. The side next the deck to be of iron plates $\frac{1}{4}$ inch thick, with overlapt joints stiffened with vertical bars of strong angle iron on the inside next the deck.

Deck Beams.—To be made of Messrs. Kennedy and Vernon's patent iron, for the main deck, 7 inches × $\frac{7}{16}$ thick.

For the quarter deck, same as the main deck, except each alternate beam, which must be 5 in. × 3 in. × $\frac{7}{16}$ in. thus—

For the lower deck and cabin sole to be all 5 inches × 3 inches × $\frac{7}{16}$ inches, same as each alternate beam of the smaller size of quarter deck; all the deck beams to be placed from 3 to 4 feet asunder, and rivetted to the side frames by angle plates to act as knees, thus—

Hatches.—To be formed in the main deck for the boilers and engines, and the fore and aft holds, made of beams of suitable strength and shapes, a wrought iron trunk to pass down from the quarter deck through the cabin, to the lower hold abaft, to be made of $\frac{3}{16}$ in. plates with flush joints and countersunk rivets.

Stancheons.—Of iron 3 inches diameter to support the lower deck beams, and $2\frac{1}{2}$ inches diameter, for the upper deck beams, one to be placed to every beam or as may be found necessary.

Paddle Beams.—To be of the box form 23 inches deep and 17 inches wide at side of vessel, tapering to outer ends to 17 inches deep, and to centre of vessel, 19 inches deep, to be formed of angle iron 3 inches × 3 inches × $\frac{3}{8}$ thick, and plated with $\frac{3}{8}$ inch iron, the angle iron at each side of the upper edge under the deck to be turned outwards so far as to form a convenient flange to bolt the deck planks to, outside the paddle beams; to be supported by strong diagonal stays of round iron well secured to side of vessel; a strong iron beam 9 inches wide and 12 inches deep to be introduced between the engines and boilers to be of the box form, made of plates and angle iron $\frac{3}{8}$ inches thick, and substantially attached to the sides of the ship by knees of plate iron.

Gunwale.—To be of angle iron 4 inches × 4 inches × $\frac{1}{2}$ inch thick, firmly rivetted to the side of the vessel and top of each side frame.

Gangways.—To be made forward and aft the paddle boxes, and cut down as far as the top of covering boards.

Hawse Pipes.—To be of cast iron with socket joints, and strong cast iron boxes at the outlets in the bows.

Rudder.—To be entirely of iron, the stock to be 4 inches diameter, and solid, extending the whole length but tapering off, so as when plated not to exceed the width of the stern, the rudder pins to be fitted into projections on the stock. The back to be formed by a tapering arm to which the plates are to be rivetted; plating to be on both sides and $\frac{1}{4}$ inch thick.

Tiller.—To be of wrought iron of sufficient strength, and firmly keyed to the rudder stock.

Channel Plates.—To be formed by bars 3 inches × $\frac{3}{4}$ inches well secured to the bulwarks and finished with an eye to receive the rigging.

Bulwarks—On the main deck to be about 5 feet high, stancheons of oak 5 inches × 4 inches at deck, and 4 inches × 3 inches at top to pass through covering boards, down sides of vessel about 2 feet, and fastened by bolts with countersunk heads, outside sheeting to be of yellow pine $1\frac{1}{4}$ inch thick, quarter deck bulwarks to be about 3 feet 6 inches high, stancheons of oak $4\frac{1}{2}$ inches × $3\frac{1}{2}$ inches at deck, and 4 inches × 3 inches at top, secured in same manner as main deck stancheons, sheeting to be of yellow pine $1\frac{1}{4}$ inch thick.

Rails—For bulwarks to be of pitch pine except the bows of vessel and across the stern, where they must be of English or African oak; to be 9 inches × 3 inches at main deck, and 7 inches × $2\frac{1}{2}$ inches at quarter deck.

Main Deck Planks.—To be of Dantzic pine, $3\frac{1}{4}$ inches thick, when cut from the saw, and 6 inches wide, fastened down by $\frac{9}{16}$ inch screws—every alternate screw to have a nut, and bolted through and through.

Quarter Deck.—To be of yellow pine $2\frac{1}{2}$ inches thick, and 5 inches wide, bolted down same as main deck with $\frac{1}{2}$ inch bolts.

Lower Deck Planks.—To be of yellow pine 6 inches wide, and $2\frac{1}{2}$ inches cut, secured as main deck with $\frac{3}{8}$ inch bolts. These decks to be well caulked in the ordinary manner with white oakum and pitch, except the quarter deck, which must be paid with white putty and varnished.

Cabin Sole.—To be of yellow pine 2 inches thick, secured by $\frac{3}{8}$ inch wood bolts.

Covering Board.—Of quarter deck to be pitch or red pine, 9 inches broad, $3\frac{1}{2}$ inches thick. These covering boards must be on tarred felt, placed between them and the horizontal iron stringers.

Platform in Holds.—To be yellow pine $2\frac{1}{2}$ inches thick.

Pall Bit.—Of English oak 12 inches square at the deck and tapering to the bottom of the vessel.

Windlass Bit.—Of English or African oak $5\frac{1}{2}$ inches thick.

Fore and Aft Paddle Beams.—To be of English or African oak 12 wide and 24 inches deep at centre.

Wing Pieces of Paddle Boxes.—To be of English oak 13 inches × 12 inches, the space of the sponsons to be fitted in with oak grating and all strongly bolted and strapped.

Paddle Boxes, outer sides and top part.—To be planked with 2 inch yellow pine well tongued together; the framework of outside to consist of two king posts and trusses of English or African oak having two $1\frac{1}{2}$ inch suspension bolts, the outside to have ornamental openings and mouldings, the sides next the deck to be covered with a neat pannelling of yellow pine $\frac{3}{4}$ inches thick, suitable steps to be fixed for walking conveniently over the paddle boxes, also neat iron hand-rail.

Gangway Planks.—to be made of 3 inch yellow pine, to extend across the vessel between the paddle boxes and the poop, to have iron hand-rails, and to be supported by strong iron stancheons.

Hatchways.—To be of suitable size; the coomings to be of African oak, and to stand 5 inches above the deck.

Houses on Deck.—Fore and the paddle boxes framed with oak or angle iron and sheeting of yellow pine, to consist of a store room, a water-closet abaft the paddle wheels, also two water-closets, sail-rooms and lamp-house forward.

Chain Lockers.—To be made forward of suitable size, with trunks and cast iron covers.

SCUPPERS.—To have three on each side of main deck made of lead about 6 inches × 3, and one large one on each side at fore part of paddle shaft.

PUMPS.—One on each side of the main compartments of the vessel to be of copper or brass 6 inches diameter with brass valves and clacks, lead tail pipes, wrought iron handle and gearing.

WATER TANK.—To be of wrought iron ¼ inch thick, and to hold about 12,00 gallons, to be placed between the after bulkhead and stern-post, to have a proper air-pipe and copper pump well tinned.

PATENT METAL.—To be used in covering the rails and other projecting parts which are usually protected with copper.

WINDLASS.—To be of dimensions suitable to the vessel, and to be worked by Gladstone's patent apparatus, or any other means of equal efficiency.

WINCHES.—To have two deck winches capable of lifting 5 tons each, conveniently fixed on deck for loading and discharging the cargo with hoisting gaffs, sheaves and chains.

BOATS.—To have two quarter boats about 20 feet and 25 feet long, each made of larch neatly finished and suitable for the vessel, wrought iron davits to be provided, necessary blocks and tackles complete, and fixed on such part of the deck as may be directed.

IRON BITS AND HAWSE SHEAVES OF CAST IRON.—To be fixed where required.

CAPSTAN.—To be of cast iron suitable for the vessel, to be fixed on the forecastle deck.

BALLAST BOXES.—Two to be provided to hold chain cables, made of wrought iron, and mounted on three cast iron wheels.

COOK-HOUSE.—To be made of sheet iron about 6 feet 6 inches square, placed on deck near the chimney, to be furnished with suitable cooking range and apparatus for 80 passengers.

SIDE LADDERS.—One on each side of the vessel, capable of being lowered, with strong iron hinges and crane, man-rope, and other necessary fittings.

ANCHORS AND CABLES.—To be a best and second bower stream, and two kedge anchors with cables, or chains of suitable strength and quality, to be of approved make.

MASTS.—To be of pitch or red pine, to have main, fore, and mizen masts, but not topmasts, to be fitted and rigged agreeably with the plan suggested by Mr. Haselden.

RIGGING AND SAILS.—The vessel to be furnished with all standing and running rigging, all ropes and chains, stays and blocks; standing rigging to be of Smith's patent wire rope, and one complete suit of sails, tarpaulings, and boat coverings of approved quality and make.

STEERING-WHEEL—To be made in a handsome manner of mahogany, neatly inlaid and mounted with brass of proper size; barrel with spindle and standards complete, with ropes, and wooden blocks, strapped with iron.

BINNACLE.—To be made of mahogany, a neat pattern, with compass, &c., and one compass in captain's room, faithfully adjusted.

LANTERNS.—To be made of the most approved construction for the mast-head and bows.

FIGURE-HEAD QUARTER GALLERIES, AND STERN CARVINGS.

FORECASTLE.—To be neatly fitted up for the crew, and suitable for the vessel; the engineer's apartments to be in the deck houses, near the engine room, and to be also neatly fitted.

DECK SEATS.—Quarter-deck to be supplied with seats, suitable for a well-found passenger vessel.

BRASS BELL.—Handsomely supported by an ornamental cast iron frame, to be fixed in the top of pall bits.

COLOURS.—The vessel to be furnished with a complete set of colours, including Marryatt's code of signals and book.

CABIN, &c.—The vessel to be fitted with an after-cabin, the full length of poop, substantially erected of the best yellow pine timber, painted and finished in a neat manner, arranged and berthed in the usual way, with steward's pantry, and all necessary lockers, &c., cupboards and fittings, stove, washing-stand basins, cisterns, pipes and cocks, water-closets and their cisterns, two neat safes, companions, skylights, and gratings, side ports, with brass fastenings, and dead lights complete, skylights and stern lights, &c., to be glazed with plate glass. No cabin forward.

IN CONCLUSION.—It is understood that all boilermakers', blacksmiths', carpenters', joiners', blockmakers', glaziers', painters', or any other work must be performed in the *best* manner, and materials supplied of the *best quality*, which may be found necessary for the completion of any part of the vessel as herein described.

EXCEPT.—Mate's, boatswain's, cook's, and stewards' stores, guns, and their fittings, silver plate, crockery, cabin furniture, and upholstery, table cloths, and other drapery, beds and beddings, cattle boards and cattle stanchions, and slings and blocks for cargo.

Liverpool, November 27, 1845.

The *Minerva* was built by Messrs. Vernon and Co., and was fitted with a pair of side lever engines, of 400 horse power, by Messrs. Bury, Curtis, and Kennedy: cylinders 70 in. diameter, stroke 6 ft. 2 in. Her speed is from 15 to 16 knots, the engines making about 91 revolutions. A more detailed account of her will be found in the *Artizan* for May, 1847.

ROYAL STEAM NAVY.

PROMOTIONS, APPOINTMENTS, &c.

Chief Engineer.—WILLIAM JOHN POOK, from the *Myrmidon*, to the *Stromboli*, *vice* KAYE, deceased.

First Class Assistant Engineer.—ROBERT DRUMMOND, to the *Jasper*.

LAUNCHES, DOCKYARD INTELLIGENCE, &c.

A court-martial has been held on the engineers of the *Vixen*, steam-sloop, Commander Jenner, on a charge of insubordination. They were all sentenced to be dismissed the service. Two of them were sentenced to be mulct of their pay, and to be confined for different periods. The *Vixen* was at Bermuda on the 9th of April.

LAUNCH OF H.M. SCREW STEAMER, GREENOCK.—On the 30th inst., there was launched from the building yard of Messrs. John Scott and Sons, the splendid iron steam-ship, *Greenock*. Details and dimensions of this vessel will be found in our No. for November last. The armament will consist of the following guns:—on upper deck, 2 pivot guns, 68-pounders, 8 inch bore, 10 feet long; 4 broadside guns, 68-pounders 8 inch bore, 9 feet long; on maindeck, 4 broadside guns, 32-pounders, 6 inch bore, 9 feet long. The weight of each pivot gun will be 95 cwt.; and the weight of each broadside gun will be 65 cwt. The engines by Messrs. Scott and Sinclair, are horizontal, 71 inch cylinders, and 4 feet stroke. The boilers are about 4 feet below the water line.

Elfin, dispatch steamer, Master Commander Balliston, went to Spithead on Wednesday the 9th, to try her speed along the measured mile in Stokes Bay. She accomplished in a mean of four runs, 12.572 knots, making 57 revolutions, drawing only four feet water aft, and four feet one inch forward. This vessel appears to be a decided failure. No fault it is said can be found with the engines or boilers, and indeed, if they are designed like the *Wladimir's*, by the same makers, we can see but little room for improvement. The power is ample in proportion to the tonnage, and we suppose the only way in which it can be accounted for, is that the boat was designed and built in a royal yard. That fact, however, now-a-days, will account for anything.

PADDLE-BOX LIGHTS.—An experiment took place at Woolwich Dockyard on the night of the 14th ult., in the presence of Commodore Henry Eden, and several other officers, to ascertain the comparative merits of the red and white lights of the lamps fitted to the *Black Eagle* steam-vessel, with the red and white lights of lamps constructed on a plan suggested by a noble lord, an officer in the Life Guards. The new lamps were under the direction of Mr. Reece, chemist, Piccadilly, and are supplied with a camphine liquid which produces a strong and very brilliant light, far superior to those in general use, and they require no trimming or attention for lengthened periods. The flame of the new lamps appears similar to the steady and uniform flame emitted from gas-burners, and it retains its brilliancy while any of the liquid remains. The lamps are said to be remarkably clean, scarcely any smoke being generated.

PORTSMOUTH.—Another magnificent structure of masonry has been added to those which already adorn this dockyard. This is a newly completed ship-dock opening into the steam basin at the entrance to the steam-factory, the work also of Mr. Peter Rolt. The dock has been finished and clean swept within the past week, and will be ready for use on the caisson being fitted. The dimensions of this dock are as follow:—Length on the coping, 300 feet; width ditto, 90 feet; length on the bottom of the dock, 260 feet; width ditto, 35 feet. The structure is faced with the finest stone; it is the largest dock yet constructed, and will consequently take in the largest ship afloat.

Niger and Basilisk arrived on Tuesday, the 15th ult., from Woolwich. They were immedietely tried, one after the other, at the measured mile in Stokes Bay, four times up and down, the mean speed being

Basilisk (paddle wheel)	knots 10·7
Niger (screw)	10·5

They afterwards proceeded to Cowes, but by some means or other, either from some bad arrangement of the boilers, or other defects, the *Niger's* boilers became red-hot, setting fire to the bottom of the vessel; the fire, however, was got at and extinguished before much damage was done. The following afternoon they both steamed into Portsmouth harbour, the *Basilisk* to repair defects in her machinery, and the *Niger* to repair damages. It will be some time before they will again proceed to sea.

BAROMETERS AT COAST GUARD AND PILOT STATIONS.—We have often been struck at the paucity of means pilots and coasting traders possess to know the state of the weather. Many often go to sea without consulting any instrument to ascertain if, in a few hours, there may not be a storm, and careless where in that case they may run for shelter, when the port they are just leaving will be shut to them for want of water. How many pilots, fishermen, or coasters, possess a barometer? We may safely say, not two in every hundred. In such a case is it not the duty of Government to establish in every station a barometrical registry? The cost would be trifling indeed, and when once the signals were known amongst sailors, we should hear of vessels saved every day by its use. We hail with great satisfaction the short code of signal we give here for the instruction of our readers, and in the name of the navy of England, we thank Commander Hall for the real service he has rendered our sailors. We hope his plan will be soon adopted in every sea-port and at every station, and we are sure that it will confer a great and lasting benefit on the sailing community. Barometer signals repeated at the Coast Guard Station, Scilly, for the benefit of the pilots, fishermen, and others, under the approval of the Comptroller-General, Captain H. Stewart, C.B.

Horizontal Tricolour Flag	Signifies . .	Fair	30.
Ball under Flag	,, . .	Change	29.50
Ball over Flag	,, . .	Rain	29.
Ball alone	,, . .	Stormy	28.

A red and white flag at yard-arm signifies rising, or inclined to rise. A ball at yard-arm signifies falling, or inclined to fall. If no yard-arm signal is hoisted, it will be considered stationary at the point signalized.

W. H. HALL, Inspecting Commander.

STEAM NAVIGATION.

THE SPANISH WAR STEAMER COLON.—A very fine steam-frigate, built by Messrs. Wigram, for the Spanish Government, and fitted with engines of 350-horse power, by Messrs. Penn, of Greenwich, was tried down the river on April 25th, to ascertain her speed, and the working of her engines. She left Blackwall at 12 o'clock noon, having on board General Viogdet, of the Spanish army, Messrs. de Zulueta, Captain Halstead, R.N., Mr. Wigram, and the Messrs. Penn, and proceeded down the river to Long-reach, where the measured mile was tried once down and once up the river, and the speed against the tide found to be 8.238, and 13.438 with the tide, making an average of 10.835 knots per hour, a very excellent result considering the size of the vessel and the power of her engines, which made from 23 to 23½ revolutions per minute with a five feet stroke, and the common paddle-wheels, which were preferred, as a serviceable description of work not liable to become deranged during service. The length of the vessel is 190 feet, with a breadth of beam of 31 feet 11 inches, and a fine sweeping deck, admirably constructed for the facility of working her guns. Her depth of of hold is 20 feet, with ample room for the engines; the whole space around them is very clear, and every person connected with them and with the boilers is under the immediate superintendence of the engineer in charge of the working of the engines. Tne engines work remarkably steadily, and during the trial gave the greatest satisfaction, as there was not the least appearance of a hot bearing, or delay on any account whatever. The armament of the Colon is to consists of two 68-pounder guns on traversing platforms, and four 32-pounders. She will carry 16 days' fuel at full speed, or 400 tons of coal, with three months' provisions, and shot and shells for service. Her principal cabins are neatly fitted up, and the whole arrangements are highly creditable to Messrs. Wigram, who have produced a war steamer of a eally serviceable description.—*Times.*

STATE BARGE FOR THE PACHA OF EGYPT.—A superb state barge, far surpassing anything in its way in the royal service of this realm, has been constructed by Mr. Camper, the yacht builder, of Gosport, for his Highness the Pacha of Egypt, and has been since finished and still continues to be an object of deep interest and admiration to the naval and nautical residents of both sides Portsmouth harbour. The barge will be sent out in the Egyptian frigate lately fitted with steam machinery by Messrs. Miller and Ravenhill, of Blackwall, for the fleet of the Egyptian potentate. The frigate will call at Portsmouth to take the boat in.

THE AUSTRALIAN MAILS.—The contract for conveying the Australian mails by sailing packets ceased the latter end of March. Since that period the correspondence to and from Australia have been conveyed by private merchant ships. In November last the Admiralty advertised for tenders for conveying the Australian mails between Sydney and Singapore by steam. It appears that the tender of India and Australian Steam Company was accepted, and the contract was to commence this month. It is now stated that the company have sent an official notice to the government of their having relinquished the contract. There has never been much doubt that the Peninsular and Oriental Company will have the contract, as being the only parties competent to undertake it. Singapore will shortly become a most important mail-packet station, from which will be forwarded mails for China, Australia, the Phillipine Islands, Java, and Borneo. An active and intelligent gentleman has just been sent out to Singapore by the Peninsular and Oriental Company as their superintendent at that port. The distance from Singapore to Port Essington, in Northern Australia, is about 2,360 miles, and from the latter place to Sydney the distance is about 2,700 miles. It is not generally known that the Peninsular and Oriental Company have a contract with the Spanish government for the conveyance of Spanish and Manilla mails to and from Gibraltar and Singapore. The conveyance of mails to Sydney throughout by steam by way of Egypt and India is looked forward to with great interest by the commercial world, for, independently of its establishing a quick communication between Great Britian and her vast Australian colonies, it will greatly improve her interesting dependencies in the Indian Archipelago, and be of great convenience to our New Zealand colonies, and particularly our settlements at the Auckland Islands, where Mr. Enderby is about to proceed to facilitate the means for British enterprise and capital being engaged in the South Sea whale-fishery.

THE EMPEROR OF RUSSIA has presented Mr. Joseph White, of Cowes, the eminent ship-builder, with a splendid gold snuff-box, set with brilliants, as a testimonial for his services in designing the alterations of two line-of-battle ships, to admit of the application of auxiliary screw steam-power. The vessels are now in course of alteration at the imperial factory at Cronstadt.

THE LOSS OF THE FORTH.—The directors of the West India Mail Packet Company have marked their sense of the gallant conduct of Lieutenant Molesworth, R.N., on that occasion, by presenting him with a handsome gold watch, accompanied by their best thanks.

LOSS OF THE RHAMSES.—The French Government have lost one of their steam-packets, the *Rhamses*, which got on the rocks off Trapani, in Sicily, and became a total wreck.

SOUTH SEA WHALE FISHERY.—A number of influential parties, captains, and others connected with this important branch of commerce, assembled at Messrs. Green's dockyard, Blackwall, on the afternoon of Thursday, the 25th inst., to witness the advantages and power of a harpoon-gun, the invention of Mr. Greener, the well-known gun maker, the Messrs. Green having fitted their fine South-sea vessel, the *Narwhal*, with harpoons and harpoon-guns. Amongst the officers and others present were Major Browne, Captain Male, Captain Baker, Captain Jarman, Mr. Richard Green, and Mr. Greener. To show the simplicity and power of the invention, Mr. Greener went into the whale-boat, and with a very small charge, only four drachms of powder, projected the harpoon, with a line attached, a distance of twenty-three fathoms, in a straight and unerring direction, and the result was stated by parties who had been engaged in whale fishing to be more than double the distance ever required. The use of the gun was then given to Mr. Macbeth, the chief officer of the *Narwhal*, and he discharged the harpoon in a most admirable manner, striking a bag of cork at thirty fathoms distant, which called forth the cheers of all present, and they afterwards unanimously expressed their approbation of the invention. Captain Jarman, of the *Favourite*, stated to the company assembled, that he had used it with the greatest success during his late voyage, recently concluded, and remarked, that although he had but one gun, and three harpoons, he shot fourteen sperm, and numbers of black whales, on several occasions killing them on the spot. The invention will do much to encourage a revival of this important branch of commerce, as the men will be less liable to danger, when using it, than they were subjected to when they had to approach within a short distance of the whales, to enable the harpoon-man to discharge the harpoon out of his hand when standing in the bow of the boat.

CORK FIBRE MATTRESSES.—A number of experiments to exhibit the power and utility of this invention took place at the City Swimming-baths, near the City Saw-mills, on the Regent's Canal, last week, in the presence of several officers of the Imperial Russian Navy, and Mr. March, of the Russian Consulate, and others connected with the shipping interest. Messrs. Thomas Paul and Co., steam-boat fitters to the Russian Government, who had prepared the seamen's bedding for the experiments, attended to conduct the experiments. The bedding, &c., of a seaman, rolled up cylindrically, according to the naval regulations, into a bundle of the diameter of 11 inches, and containing a mattress of the cork fibre weighing 9 lb., was found sufficiently buoyant to support above the water three persons who clung to it. A raft was then constructed with great expedition, with oars and mattresses of the cork fibre, or cuttings, being about six feet in length and eight feet in width; upon this three of the company floated high and dry, and it was very apparent that it was capable of supporting many more. The efficacy of this invention, though severely tested, was fully proved. The Russian officers present expressed their satisfaction at the result of the experiments, and stated that it would prove very useful in those vessels of the Imperial navy employed on the Circassian coast of the Black Sea, where shipwrecks are of frequent occurrence. Some further experiments, with small bolsters, intended for emigrants, were also made, which proved that a very small quantity of the material would float a man, and enable him to escape drowning from shipwreck.

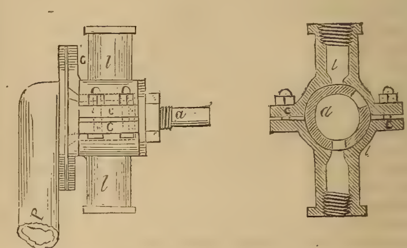
VALVES AND COCKS FOR BATHS AND WASHHOUSES.

(Continued from p. 104.)

In corroboration of what I have advanced in regard to the valves at the Baths and Washhouses, Trafalgar Square, and likewise those at Goulstone Square, Whitechapel, I beg to mention the following diverting scene:—A friend of mine, in the habit of using the baths, went in as usual a short time ago, and observing a valve out of order, inquired the reason; a tooth had been broken in the small mitre gearing, a thing which he was informed, was continually happening. When in his bath, the water being cold at the bottom, he called out as usual for a further supply of warm water; "Yes Sir," said the man, and he turned on the hot water; when the bather found the water warm enough, he said "I shall not want any more, you may turn it off altogether." Upon this being attempted, in flowed cold water; my friend announced the intrusion, and the attendant in attempting to shut it off, again turned on the hot water. At last he did accomplish the required feat of shutting off the hot, at least to such extent that the small admission was not of any consequence; the result however is, that the valves leak so much, that you must have either cold or hot in a greater or less quantity. This same party visited a good many of the baths, and could hear the water running away through the waste when they were *said* to be shut off. In fact they are so unfitted for the purpose, that they will either have to be taken away altogether, or attempted to be constructed on a new principle and arrangement.

In the woman's baths it often takes two women to turn the handles and sometimes they cannot turn them at all; if they are loose enough to be easily turned, the water flows through them. In the Marylebone Baths and Washhouses they intend to have two-way cocks of about four inches for the largest diameter of the bore, and fitted with stuffing boxes; now these, I am of opinion, will do moderately well for steam cocks used occasionally, but as large cocks for hot and cold water in such constant use, they are not likely to answer well for any length of time, besides being expensive in the first instance. The principal reason why you cannot keep large cocks tight, is the conical shape of the plug; as the large diameter passes through a greater space, in a given time, than the smaller one, the wear is more on the larger diameter, and the apparatus becomes thereby imperfect; the greatest angle likely to answer for a large plug is about four degrees; cocks do pretty well if the plugs are not more than from one inch, to one and a quarter inch largest diameter. A large cock may be constructed to answer if made after the following plan: Fig. 2, a sketch of a two way cock, on the improved principle.

FIG. 2.



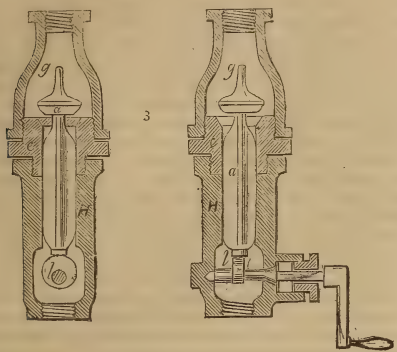
a, a, is a cylindrical hollow plug having two ways into it and one end having a conical ring made to fit into the flange G. *b b*, casing showing connections of hot and cold water pipes, the case *b b* is cast in two pieces with flanges CC, the flanges are fitted with steel steady pins and bolts and nuts to tighten as the plug wears. P pipe to cistern.

I have had one or two of these cocks made, and find them wear well, but they are expensive, as they require good workmanship.

Let us now investigate the different kinds of valves in use, their proportionate price and general application; and we shall find that the seat valve breas the test of wear and tear combined with lowness of price, above all others. Seat valves are employed universally in hydraulic presses, steam engines, cisterns, waterclosets, and in fact in almost every situation where a perfect valve is required for constant use. Such being the case, it must be a monomania after something new, that can induce men to apply intricate novelties in situations requiring the cheapest and simplest apparatus, strength and durability being the grand requisites.

The seat valve I have invented has the following advantages:—small first cost, easily constructed and kept in repair, durability, and simplicity; these I consider the requisites for a valve suitable to baths and washhouses; and the one shown in the following sketch, forming a portion of a common wrought gas-tubing connection, is a copy of one that has been at work for

some years, and answers perfectly. It is to be understood that there must be one of these valves to the hot and one to the cold water-pipe placed side by side, so that the attendant can take the handle off one spindle, and put it on the other as may be required. It is better to have one for the hot and another for the cold water-pipe, as by this arrangement the hot water may be carried to the bottom of the bath and the cold to the top.



In regard to the waste-water valve, there cannot be anything better than the old seat-plug, similar to the ones used in a fixed wash-hand basin. By a simple arrangement of bell-wire and cranks, it can be acted on by the party inside the bath, and should such happen to fall asleep, the water can be let off by the attendant pulling the handle outside.

I will here insert a few observations on the sluice valves of the mains; the valve and seat, where not in constant use, should be of gun metal, but in those situations where they are used daily they may be all iron, the reason for which is, that iron ones might get red with rust if they remained long without being used, and all these kind of valves made with springs at the back are to be avoided; set screws answer better.

There are various causes in the manufacture that make cocks and valves imperfect; one is, that in grinding with emery, minute particles of the emery work into the surface of the metal, and carry on the process of grinding when the valve is in use, thereby deteriorating it; burnt sand from the foundry is the best thing to grind plugs in with.

Another cause sometimes makes cocks and valves imperfect; it is that one particular spot in the metal is harder than the general surface, causing the whole to wear unequally.

Lime and silica, in many situations, held in solution by the water, deposit more in the vicinity of the valves, when they are composed of gun metal and iron, from galvanic action.

Taking all the liabilities of the valves to get out of order into consideration, it becomes an important point so to place and adjust them that they may easily and speedily be got at, and arrangements made, that they may be taken out and repaired without stopping the general business of the place. It is of vital importance that when once the class, for whom baths and wash-houses are intended, have contracted habits of cleanliness, they should not for one instant be allowed to think that such habits can be dispensed with, as man being so much the creature of custom, if the habit for one week be neglected, it becomes easier to neglect it the next, and easier still on the next ensuing, until it is neglected altogether.

W. M. Wrather,
2, Barton-street. *Consulting Engineer.*

(The Architect and Building Operative.)

ON BORING THE EARTH FOR MINERALS, ARTESIAN WELLS, AND OTHER PURPOSES.

BY MR. JOHN THOMSON.

Gentlemen:—The geometrical progression of practical science during the past half century must be apparent to every thinking person; the advancement of any one science generally affecting some other in a greater or less degree, and thus producing a universal movement.

I beg leave, through the medium of the Journal, to point out an art which has received no material improvement in this country, although its claims are strong and of paramount importance. I allude to boring the earth for minerals, artesian wells, or other purposes.

The enormous labor, delay, and other vexations attendant on rod boring, are well known, and do not require examples to enforce conviction; yet strange to say, that same old awkward system even yet holds good its footing. The Chinese method, which is much more simple and effective, is being adopted in Europe, and might be also here. It consists of an armed weight, (say one, two, or three hundred pounds, as the case may be,) of a particular form, attached to a peculiar rope, to withstand the friction on the sides of the bore hole, whilst at work, and being suspended from above by a spring, on which two men are seated. The weight is made to bob up and down by their exertions, striking the bottom at each depression of the spring, the boring being advanced with considerable rapidity. The clearing of the detached matter by this method, is also very much facilitated as compared with the rod boring system.

These are the only two methods at present known, for boring the earth to any great depth, and they do not admit of much improvement.

But I contend that other methods may be found to supersede these, and would suggest the powers of the electro magnet, an agent whose limit of energy is yet unknown. The small space through which it can exert its immense powers, renders it peculiarly adapted to boring purposes, either perpendicularly, horizontally, or at any other angle; being a particular advantage gained over any of the other methods, and quite applicable to direct mining.

Suppose, for instance, a short boring instrument to have a common magnet inserted into it, with the poles uppermost. Again, suppose a mate to this magnet, of the electro description, firmly inserted into a heavy weight. Next let us imagine these two magnets to be set upon each other, face to face, the under one with its boring tool, and the upper with the weight. It will be evident that, by connecting an electro-magnetic battery to the upper magnet, and reversing the polarity as usual with that machine, a power will be exerted between these two magnets, tending, at each alternate reversal of polarity, to separate them and produce a shock. Such is the principle upon which I propose my mining machine. If the weight which bears upon the magnets be 3 cwt., and the magnets to have a sustaining power of 2 cwt., action and re-action being equal, I ask what would be the impinging power exerted by the borer upon the imposing rock, when in operation?—for certainly this is a projectile, and must be calculated accordingly.

Suppose the battery to reverse its polarity 10 times a second, and the magnets to separate only the thousandth part of an inch at each pulsation, (the clearing of the hole by the recently invented method of pumping water down, being approved of,) the progress will be found to be three feet per hour.

I do not calculate on receiving any benefit whatever from the attractive principle of the magnets; but I receive in full the whole amount of their repulsive energy. The weight which loads the magnets being superior to the sustaining power, the stroke can never have an ascending tendency; the boring machinery must sink while the battery on the surface is in operation, and the weight which loads the magnets, follows the descending borer by its own gravity. In boring from the surface, the battery remains above, and the wires connect with the magnet, however deep the workings may be, the points being shielded from danger of soiling by a simple sheath. As the borer will remain constantly at the bottom of the hole, there will be no power lost, as in the other methods, by the displacement of the loose matter at every stroke of the cutter.

Not being a practical miner, although I have investigated the theory somewhat, I would leave the form of the cutting tools to those better versed with that subject, remarking that, in cutting hard rock, a single chisel would get wedged in; but by using two common magnets, with a chisel to each,—a positive end of the one magnet, and a negative of the other, being presented to each end of the one electro-magnet,—they would work alternately, and at every reversal of polarity; producing a double effect, and freeing each other's chisel at every stroke.

This electro-magnetic method of boring admits of being carried to any depth, as the magnets descending with the chisels, carry with them the same amount of energy as when at the surface, and as the sustaining power of the electro-magnet may be increased many fold above the example I have instanced, it leaves no doubt in my mind, but that a powerful agent is here presented to the mining interest of the country.

Regarding lateral borings, it is only necessary to use pressure on the magnets, instead of the heavy weight with which I have illustrated my description, and the mode in which it will be applied, will depend on the nature of the work to be executed. From the friable nature of coal, I should say that this machine might be introduced into the mining of that mineral with certain success, as an auxiliary to the men, in the manner of a pioneer, in cutting always in advance of the workers, leaving them merely the work of pulling down the walls which it has bored into and undermined.

I have been as concise as possible, but I hope sufficiently clear to convey an idea of the principle. I have never attempted it in operation, but recommend and leave it to any party who may feel interested. I believe the idea to be new and good, and take this method to throw it to the world, for others to improve.—*Franklin Journal.*

QUEBEC AND HALIFAX RAILWAY.

THE final report on the proposed Quebec and Halifax Railway has recently been presented to Parliament, and is a document of considerable interest. According to Major Robinson, by whom the survey was conducted, three principal lines present themselves for a trunk railway from an eastern port in Nova Scotia, through New Brunswick to Quebec, and by combining portions of two of these lines together, a fourth and fifth route may be formed. The shortest of these routes is 595 miles, and the longest 692 miles. The one recommended is the Halifax and Eastern, or Bay Chaleurs route to Quebec, and the length of this is 635 miles. It runs from Halifax to Truro, thence up to Bathurst, then along the shore of the Bay Chaleurs to the Restigouche river, then across the valley of the Metapediac over to the St. Lawrence, and so along the banks of that river to Quebec. The principal recommendations of this line are the prospect of its opening up a large field for provincial improvements, for the settlements of emigrants, and also for developing the commerce and fisheries of New Brunswick. The neighbourhood of a great portion of it to the sea coast would add to the facilities of construction, and remove the chances of interruption from the effects of climate. The extent to which the line will pass through crown lands is estimated at 375 miles. A single line of rails is proposed in the first instance, space being reserved for a double track at any future period. A substantial and permanent mode of construction, with a good heavy rail capable of bearing high rates of speed, is recommended, and some facts quoted, which, however, do not seem conclusive, against the cheap method of making railways in America.

The most expensive lines in the United States have been those of Massachusetts. Their cost is estimated at £7,950 per mile. The Halifax line, however, will escape the duty on iron, which is levied in the United States, and thus save £500 per mile. Labour also is much cheaper than when the Massachusetts lines were constructed. The greater portion of the land will be granted free of cost, and timber and stone can be had nearly along the whole distance. Under these circumstances it is considered that £7,000 per mile may fairly be assumed as the probable limit of cost. This, for 635 miles will be £4,445,000, making with the addition of 10 per cent. for contingencies £4,889,500, or in round numbers five millions. With regard to revenue, it is considered that the total population, either upon or near the line, including the two termini, may be estimated at 250,000 persons, and that the whole number within the area, which will be benefitted by the line, will not be less than 400,000. The nett earnings of the Massachusetts lines give a proportion of 11s. per head for the entire population of the state, and taking a nearly similar calculation in the present instance, that is to say, 10s. per head (a rather sanguine estimate when it is recollected that one-fourth of the people are French Canadians), we should have a return of £200,000. The transit of timber, the great staple of New Brunswick, the products of the fisheries, coals from the great Cumberland field, flour, grain, and other articles, are, however, also to be taken into account, and as the St. Lawrence is closed six months in the year, not only would the railway have a monopoly during that time, but it would prove of inestimable value to the colony in setting articles free, which are now so long locked up. Flour and wheat from the far west of the United States are also calculated upon, since while it costs 5s. 1d. to convey a barrel of flour from Illinois and Michigan to New York, and 6s. to Boston, it could, it is alleged, be brought to Halifax for 4s. 2d. Under these circumstances an ultimate return, such as to render the line a productive one, in a commercial point of view, is regarded as a reasonable anticipation. But a line from Montreal to Portland in Maine, now constructing, will, it is admitted, be a great competitor with the Halifax and Quebec route, and this alone would render the return sufficiently uncertain to deter capitalists, unless the inducement were offered of a definite guarantee. To the welfare of the provinces, the undertaking would be a vital one, and a guarantee is accordingly recommended. A loan of £3,000,000, it is suggested could be raised upon the provincial revenues at 4 per cent, if guaranteed by the mother country, and this with 2,000,000 acres of land that would be brought into value by the line, might prove sufficient. "The issue of a large amount of notes," upon the credit of these lands to be paid to the labourers for wages, and to be receivable for taxes is among the expedients contemplated, and a variety of reasons are given for it, which remind us of the schemes which abounded in this country during the excitement of 1847.

In the correspondence on this report of Major Robinson, which notwithstanding the suggestion for the note issue, is a very able and interesting one, the opinion of the commissioners of Railways is given, that although the undertaking may be of great importance in a military and political point of view, the results in a commercial sense would be very doubtful. In a subsequent dispatch from Lord Elgin, dated Montreal, December 20th, 1848, a minute of the committee of the executive council is transmitted, expressing an earnest hope that the home government will recommend the work to the favourable consideration of parliament, and suggesting that as the protection in favour of colonial timber is likely soon to be withdrawn, a desirable plan of obtaining a revenue, sufficient to meet the interest on the proposed loan, would be to abstain from reducing the duty on foreign timber, and to raise the duty on colonial from 1s. to 7s. 6d. per load. What has been the reply to this proposal, which is simply that the mother country should tax herself to pay the entire amount, does not appear; but however desirable for the welfare of the North American Provinces the work may be, we cannot help thinking there is not the smallest prospect at present of it being carried out on the scale proposed. Some cheaper and more gradual methods must be hit upon, and amongst these the construction of a plank road upon the model of those which now promise to be so successful in the United States, might prove not unworthy of consideration.—*Times.*

PROCESS OF CARBONIZING TURF WITHOUT CLOSE VESSELS.

BY DOMINIQUE ALBERT, LL.D.

WHEN, in 1835, I built my present works at Cadishead, I was chiefly induced to choose the place on account of the proximity of both turbaries, Chat Moss and Barton Moss, having previously ascertained that I could make with turf as good charcoal as with wood. As the charcoal I wanted was for some chemical purpose other than to be used as fuel, the first condition of the carbonization was, that it should produce a vegetable black, free from the mineral substance mixed with it, as is always the case when turf

is carbonized in Ireland, to supply the hearths of some country smithies. I began then, by submitting the turf to a dry distillation in iron retorts, five feet deep to four feet diameter, covered with strong sheet-iron caps, to which I adapted cast-iron pipes. I soon found, however, that the quantity of auxiliary mineral fuel required to burn the turf, owing to the distance of seven miles from the nearest pits, rendered this method too expensive to be continued.

I expected that the acid would compensate for the price of the coal, but I could never get it above two or three degrees; besides, the pyroligneous alcohol diluted in the acid existed in a very small proportion. The tar, which was comparatively abundant, contained the greater part of the spirit; but the low price of tars in general offered me no encouragement to proceed. I knew, by the discoveries made by my countryman, Mr. Merle, in 1834 and 1835, that certain species of turfs gave a richer and superior gas than either coals or oils; and I am convinced myself that the peats in my neighbourhood were of an excellent quality for such a purpose, but I did not feel inclined to set up any apparatus to save that produce, so I turned all my attention to find a cheaper mode of producing pure charcoal. I had latterly observed the Irish in their process, which consists of setting fire to a few turf cakes placed on the ground, so as to let the air play between. As soon as these cakes are burning, they heap round and above other cakes which very soon ignite also. They continue to feed thus this heap of fire, till it reaches about five feet in height, and six or seven at its base. They let it burn till the whole appears in a complete glow, when they cover it with large wet sods, either of soil and grass, or heath sods, from the surface of moss land. This careless, but cheap and easy manner, causes the charcoal to be mixed with a quantity of uncarbonized vegetable, marl, sand, stones, and a notable proportion of ashes, all matters which do not affect the iron jobs with which they come in contact.

The Dutch I saw, many years ago, carbonizing peat for domestic purposes in small conical furnaces, as common with them in the country places as the bread ovens are here. They light the turf from below; and when the combustion is nearly completed, they close the top and bottom. Their method, though superior to the Irish, and well adapted to their object, is neither as complete, nor does it give so pure an article as I wished; besides, I found its application almost impossible on a large scale. Amongst the different plans and instructions I consulted to assist my experiments, I gave the preference to a large round perpendicular furnace, in which, according to Dumas *(Chemistry applied to the Arts)*, Mr. La Chabeaussière distils wood. After having studied what modifications were necessary to render Mr. La Chabeaussière's furnace useful for the carbonization of peat, without saving either gas or liquids, I constructed the following kiln:—On a solid soil, I made an excavation from ten to twelve feet wide at the top, nine feet deep, and nine in diameter at the bottom, which I covered with a dry brick floor, that had a convexity of six inches. I lined this hole round with a dry brick wall, in the way of a common pump pit. At four equal distances at the bottom of the round wall I opened an air-hole of about four inches square, and continued it in the form of a narrow chimney outside the wall, to the height of about six feet, when I prolonged it about six feet more, but in a horizontal direction. For the top of this kiln I had a sheet-iron cover made, a few inches wider than the diameter of the brickwork, of a convexity of two feet, with a round hole or chimney in the centre, one foot high, and nine inches diameter, provided with a cover and handle similar to that of a canister, and at a foot from the extremity of the large cover, are cut out four auxiliary chimneys, at equal distances one from the other, with a four-inch diameter. Four strong iron rings are fixed to the cover to receive the hooks of a chain, which, by means of a double purchase, raises or lowers the cover. When this furnace, says Dumas, is filled with wood, the cover is lowered down, and some fire-brands are precipitated through the centre chimney to the bottom of the kiln; the wood being placed so as to leave a sort of funnel open. By means of the four blowing air holes, the fire is very soon spread in all directions, and its progress is to be regulated by shutting or opening the smoke and air-holes, according to the direction of the wind.

These rules, which no doubt did answer when wood was to be distilled, were inefficient when applied to the carbonization of peat; but by dint of trials and patience, I succeeded beyond my utmost expectations, upon the following plan:—I made two tunnels of inch board, nine feet high and eight inches square, with some hand-holes from distance to distance. These tunnels I place in the kiln along the side, in order that the bottom end may correspond with one of the four air-holes; one of my workmen descends then to the floor of the furnace, and forms an ærated bed with peat, by setting the cakes upright, with their tops inclined one towards another, so as to create a good draught, which must, as much as possible, run in the direction of both air-holes where the tunnels are standing. It is necessary for this operation that the cakes be entire and dry, as pieces would intercept the air, and a wet cake would paralyse the action of the fire. After the setting of this bed, the peat is thrown down upon it, and left in the natural confusion of its fall, only it is required that a man place round the tunnels the turf cakes in regular order, to build like a chimney round these moveable tubes. When the kiln is filled and heaped up about three feet above the level of the hole, the tunnels are drawn out by means of their hand-holes, and leave two square passages from top to bottom. In these temporary chimneys, a few incandescent peat cakes are thrown, and on these some broken pieces of turf, till the passages are filled; but as the air plays more freely through these former chimneys, some barrowfuls of peat crumbs will shut the too wide pores, which places are easily seen by the greater volume of smoke escaping from them. The kiln left open, to facilitate a more general conflagration, is not covered before the heap of turf cakes has sunk to the level of the brickwork. In this state, the cover is let down, and some soil is brought round its border to intercept the escape of smoke. In this state of carbonization, all the air-holes with the large and small chimneys are open. As soon as the fire is perceived through either of the small chimneys corresponding with the passages where the fire has been lighted, the horizontal mouth of the same air-hole is to be shut with a piece of brick and some marl, and the others are to be successively stopped in the same way, the moment the redness of the fire can be distinguished. If there remains any doubt of the perfection of the operation, a pole about fourteen feet long should be thrust into the hole where the carbonization appears incomplete, and by thus guaging to the bottom of the surface, you will immediately be aware of the state of the charcoal, which you can remedy instantly, by opening the air-hole opposite the place examined.

When the smoke begins to abate, you place the cover on the central chimney, but so as to shut only the half of the aperture, taking care at the same time to direct the open part of the cover towards that part of the kiln which you might consider not so perfect as the remainder. At last, when the eruption of smoke has ceased, you shut all chimneys immediately, and the operation is at an end. It requires generally 24 hours to complete the carbonization of one furnace, and 60 hours for carbonization and cooling of the charcoal. A kiln of these dimensions can receive between three and four one-horse loads of peat, of about 14 cwts. There are three kinds of peat. The white, or top of the moss land, is the lightest, and consequently the worst; it is sold from 4s. to 5s. the load. The brown, which comes from the second stratum, is much better, being more compact, and sells at 5s. 6d. per load. The black, or best quality, sometimes called iron-turf, is very hard and heavy; it gives an intense and sharp heat; produces a thick black smoke, with strong and unpleasant smell; it burns slowly, and is bought at 6s. The incineration of the black turf leaves heavy reddish ashes, whilst those of white turf are of a sulphur yellow, and those of the brown have often a sort of orange tinge. The peat ashes, which owe their alkaline quality chiefly to the presence of lime, are considered a good manure for grass and clover, and used as such in the north of France and Belgium. March and April are the best months to use them. They are generally sown during damp weather, and will have a good effect used with any plant, at its first appearance above ground. I tried them last year with peas and other vegetables, and perceived in one instance, that the use of them cleared the cabbage plants of the insects that were devouring them. In order to get the kiln to act more regularly, it is well to carbonize each sort of peat separately. I have at present four furnaces or kilns at work; they are

constructed between two rails, on which I have built a moveable frame, with a roof covered with a tarpauling. This skeleton of a house answers two purposes; namely, it enables the men to fill and empty the kilns in all kinds of weather, and affords to the whole line the use of the double purchase to wind up the heavy iron covers. The white turf gives a fourth of its weight of charcoal, the brown a third, and the black one-half. The nature of charcoal from peat is a great deal less pyrophoric than that of wood charcoal; and during the four years that I have had always large quantities in the interior of my works, I have not had a single instance of a spontaneous ignition, whilst I had two accidents of this nature with wood charcoal in the short space of six weeks.—*Mining Almanack.*

ANALYSIS OF PATENTS.

George Emmott, of Oldham, in the county of Lancaster, civil engineer, *for certain improvements in the manufacture of fuel, and in the construction and arrangement of furnaces, flues, boilers, ovens, and retorts, having for their object the economical application of caloric; the manufacture of gas for illumination; and the consumption of smoke and other gaseous products.* Patent dated June 16, 1848.

THIS patent consists of various arrangements of boilers, coke ovens, and gas apparatus, by which it is supposed that an economy of fuel can be effected and the smoke consumed. The most important points of the invention may be described as follows:—A coke oven, or rather retort, is provided with an exhauster, which fills a gas-holder with the gas produced from the coking of the coal, and which gas would be ordinarily wasted. The coke and the gas are then to be burnt under a steam boiler in the following way:—The boiler is fitted with two lengths of fire bars, the first of which are set very close together, and may be considered, in fact, a prolongation of the dead plate, with room for the admission of a small quantity of air. The second set of bars incline *upwards* from the first set, and are set wide apart; the firebrick bridge is pierced with holes to convert it into a gas-burner, and is connected to the gas-holder with proper pipes and cocks. The bridge is also provided with a longitudinal valve in front, for the admission of cold air, and worked by a handle in the stoke hole. The application of all this apparatus is thus:—The first set of bars is fed by hand with small coal, or coal dust and tar, or similar fuel, and the second set by machine (or by hand, if more advisable) with the coke produced in the retort, or coke oven, and the bridge is supplied with gas from the gas-holder, and with air by the valve. The consequence is supposed to be, that the smoke from the bituminous fuel on the first bars will be entirely consumed in passing over the red hot coke, and through the blaze of gas light on the bridge, being duly supplied with cold air by the valve in front of the bridge.

Deane Samuel Walker, of London Bridge, merchant, *for improvements in the manufacture of bands or straps, for hats, caps, shoes, and stocks.* Patent dated June 24, 1848.

THE patentee proposes to form hats without a seam by weaving a cylindrical fabric and applying it to that purpose; and secondly, proposes to form hat-bands of a fabric, woven with circular loops, so as to allow of a certain elasticity, or by combining cloth and sheet india rubber, or by forming a pile upon sheet india rubber—by any of which means an elastic band will be formed which can be put on the hat without a joint.

John M'Intosh, of Glasgow, gentleman, *for improvements in obtaining motive power.* Patent dated June 28, 1848.

THIS invention consists in an improved method of constructing rotary and semi-rotary engines. The rotary engine consists of a piston revolving in a cylinder, inside of which is a smaller one, the space between them being the surface of the piston which is attached by an arm to a central revolving shaft. The interior of the cylinder is lined with a band of strong flexible material, which is pressed against the cylinder to render the joint steam tight. The steam and exhaust pipes are fitted as usual, and on the steam being admitted, the flexible band communicates the pressure to the piston, and admits of its rotary motion. The semi-rotary is of similar construction. Another arrangement is described in which a flexible tube transmits the pressure to the piston by acting against a roller on the end of the piston. This idea is almost identical with one of the proposed compressed air railways, in which a roller attached to the carriages was to be driven by the pressure of air exerted inside a flexible tube on which it pressed.

Henry Archer, of Shaftesbury-terrace, Pimlico, Middlesex, *for improvements in matches, and in the production of light, and in the apparatus to be used therewith.* Patent dated June 24, 1848.

THIS invention is divided into five parts, the first relating to matches to be used as tapers for sealing letters, &c. A match taper, tipped with some inflammable composition, such as is commonly used for these purposes, is inserted into a short and thick taper, formed either conical or cylindrical, having at bottom a piece of metal, or other material, suitable for preventing the wax, or composition, from running about when the match is nearly burned out, and causing the whole to readily stand on its base. The match taper may, however, be merely inserted at foot in a small block of lead, the object being to maintain the match in an upright position during the process of sealing.

The second part of the invention has reference to the burning of hydrocarbons for producing light, by mixing them with other liquids, in order to prevent their smoking, or giving off portions of unconsumed carbon; for which purpose it is proposed to mix one part by measure of ordinary camphine, or coal-tar naptha, with two parts by measure of wood naptha, or pyroxilic spirit, whereby it is stated, an inflammable liquid is produced, that will burn with great brilliancy, and will not smoke, like the pure camphine. Sometimes three parts of pyroxilic spirit to one of coal-tar naphtha, or camphine, and sometimes equal quantities of both may be used; but, for ordinary purposes, the proportions first mentioned are preferred.

The third part of this invention has reference to the manufacture of night-lights, which merely consists in the use of a thin metal case, for holding the inflammable liquid, such, for instance, as the collapsible tube, patented by Mr. Rand, into which the wick is to be inserted, the top being covered in around it. For this purpose the match-wick, stepped in lead, as before described, may be used. This method, it is stated, may be adapted for portable lamps.

The fourth part of the invention relates to pressure lamps, actuated by weights or springs, so as to cause the oil or inflammable liquid to be pressed up to and supply the wick. Within an outer casing, or cylinder, a flexible bag is placed, having at top a metal plate or cap, with an aperture for the wick, and at bottom a plate, but without the aperture; one end of a coiled spring being attached to this plate, the other end having an abutment within the lower part of the outer casing. It is evident that the flexible bag, being filled with oil, will press against the spring and collapse it; but this, as the oil burns away, will press up and collapse the bag, so as to keep the level of the oil up to the wick. In order to trim this lamp, the cap, or top plate of the bag, is to be unscrewed; and, to prevent the bag being pushed out of its place, there is a cord attached to the bottom plate, which is secured at the lower end to a small roller at the bottom of the outer casing; this roller, being turned down, pulls the cord, and thereby counterbalances the spring.

The last, or fifth, part of the invention relates to ornamental chimneys, or shades of glass, for lamps and gas burners, and consists in corrugating them obliquely or horrizontally, so as to give a pretty effect to the flame.

The patentee claims—1. Making matches, as shown and described, so as to cause them to stand in a vertical position with facility.—2. Preparing and mixing camphine as described.—3. Manufacturing night-lights, as shown and described.—4. The improvements in pressure lamps, effected by the use of a flexible bag or case, supplying the oil or inflammable liquid, by means of pressure exerted externally.—5. Corrugating the glass chimneys or shades for lamps or gas burners, either obliquely or horizontally.

Willam Hunt, of Dodderhilll, in the county of Worcester, chemist, *for improvements in obtaining certain metals from certain compounds containing those metals; and in obtaining other products by the use of certain compounds containing metal.* Patent dated June 24, 1848.

THE first part of this specification contains a description of a method of treating the slag of iron, whereby the metal may be extracted therefrom. It is proposed to granulate the slag, either by allowing it to run from the furnace into water, or by crushing it with proper machinery, the granulated slag, being then mixed with a proper proportion of coal and reduced in a reverberatory furnace. Copper slag is to be mixed with the raw sulphurous ores and coal and treated in a similar manner. The second part contains a description of a new method of making sulphate of soda from muriate of soda or common salt. The ordinary way is to expose the salt to heat in a furnace, adding to it dilute sulphuric acid, and afterwards roasting it at a higher degree of heat, the fumes of muriatic acid being condensed in a chimney filled with lumps of flint, kept moistened by a stream of water. The patentee proposes to employ artificial sulphuret of iron or of manganese, which is to be mixed with the salt, and the compound to be submitted to a proper degree of heat, the products being sulphate of soda and oxide of iron.

Richard Clark of the Strand, in the city of Westminster, lamp manufacturer *for certain improvements in gas-burners, and in candle lamps, and other lamps.* Patent dated June 26, 1848.

The invention claimed under this patent consists: First, in the several plans shown (or any mere modification thereof) for entirely inclosing gas burners within a glass or chamber, so as to protect the flame from external draughts and cause the air which supports the combustion of the gas to be thoroughly heated before it arrives at the burner, also ornamenting the glass chamber in order that the metallic part of the burner may be hidden from view as much as possible, and yet, at the same time the passage of the light may not be impeded or its quantity diminished. Secondly, the various improvements in gas burners, and also the improved modes of supporting the chimneys and glass shades, and preventing them from becoming accidentally misplaced. Thirdly, the method of constructing burners whereby any irregularity or want of uniformity in the pressure of the gas from the mains is prevented from injuriously affecting the flame. Fourthly, dividing the coiled spring of a candle lamp into two parts, and also adapting a tubular or other piston to the upper part of the spring, one of the objects of both these improvements being to facilitate the placing the spring within the tube after it has been removed for some necessary purpose; another object in dividing the spring into two parts, and separating them by discs, being to prevent the melted tallow from getting into and clogging up the lower part of the spring. Fifthly, the constructing night lamps with a curved or hemispherical bottom, so as to cause the melted tallow or grease to drain down to the lowest point, and be consumed. Sixthly, the constructing oil and other lamps as described, whereby the flame is or may be protected from external draughts, and yet be abundantly supplied with air to support combustion. Also the manner of adapting an oil cup to the lower part of the lamp for the purpose of receiving any overflow of oil; and also the improved mode of constructing the stuffing-box, as well as the method of attaching glass handles to spindles for any of the purposes to which such handles may be applicable. Seventhly, the constructing pressure lamps with a strainer or percolating surface adapted to or made in the lower end of the supply-pipe, for the purpose of preventing any impurities from passing into the interior of the lamp and clogging it up; also the making of a valve or valves, in the piston or plunger of pressure lamps, for the purpose of allowing any air that may have accidentally got under the piston or plunger to escape therefrom. Also, the method described of regulating the supply of oil to the burner by means of a small plug or screw on unscrewing which, the capacity of the passage may be regulated at pleasure; also the constructing pressure and other lamps with short wicks for the purpose above set forth; also the support described. Eighthly, the regulating the supply of oil to railway lamps by means of a plunger or spindle, whereby the flow of oil may be regulated to a nicety, or stopped altogether if required. Ninthly, the making lamps or lanterns with reflectors which may with facility be detached from them or adapted thereto when required; also, the magnifying, by means of a lens, the rays of light upon the focus of a reflector. Lastly, the counterbalancing chandeliers by means of weights inclosed in the tubing which forms the channel of communication from the main to the burners in the case of gas lamps, and which only serve to support the chandelier when oil is used.

Joseph Skertchley, of Ansty, Leicestershire, gentleman, *for improvements in bricks, and in the manufacture of tobacco pipes, and other like articles.* Patent dated June 30, 1848.

The first part of this invention relates to the forming bricks with dovetailed grooves in their faces, for the purpose of holding the plaster or cement, with which they are to be faced, more effectually; the second part relates to the manufacture of tobacco pipes by machinery. The main features resemble those of drain-pipe machines. The clay after being prepared by rollers, is squeezed by a piston through dies, consisting of a series of plates, which are moved so as to vary the thickness of the stem of the pipe, and to allow a boss of clay to pass through to form the bowl by a subsequent operation. Another method consists in passing the clay through a rolling-mill, the indentations in which are of a suitable section to form the stem and bowl of the pipe. Various plans are described for boring the stem, either during the first shaping process or after. An earthenware frame is also described on which the pipes are packed to be burnt; by this means the kiln may be more quickly filled and emptied.

Mathew Kirtley, of Derby, engineer, *for improvements in the manufacture of railway wheels.* Patent dated July 11, 1848.

This invention relates to a method of forming the spokes of wheels by rolling the iron to a proper shape, instead of forging it, in cases where the spokes are of bent iron, the ends being brought together at the nave of the wheel. The rollers of the mill may be suitably grooved to produce the desired shape, or dies may be used with plain rollers. A method is also described in which the ends alone are rolled, and then welded to the spokes.

Nathaniel Beardmore, of 13, Great College-street, Westminster, *for certain improvements in founding and constructing walls, piers, and breakwaters, parts of which improvements are applicable to other structures.* Patent dated July 3, 1848.

These improvements consist in forming piers and other marine structures of caissons of wrought iron, which would be built in a convenient situation and floated to the spot where they would be required, and then sunk and filled up with proper concrete, brickwork and masonry. We extract from the specification :—"The caisson or enclosure employed for the founding and constructing of walls, piers, and breakwaters, consists of wrought iron plate bottom, sides and ends, and occasional transverse bulkheads, strengthened by ribs, and firmly connected together, so as to withstand pressure in every direction, for floating the walls and other materials from the place of construction to the site of the proposed work; the whole being so bonded together as to constitute one entire frame, of great strength, solidity, and power of resisting strains. The bottom of the caisson is formed of boiler plates rivetted together so as to form one uniform sheet, to which is connected by angle irons, firmly rivetted thereto, a series of vertical plates, extending the whole width of the caisson. To the upper part of these vertical plates, a second set of angle irons are rivetted, so as to cause a ledge or shoulder to project therefrom on each side, by which cells are formed, to be afterwards filled in with concrete, brickwork, masonry, or other material, fit to resist the displacement of the plates; such concrete or other material being pressed or built and well grouted close against the plates and into the angles; the combination thus forming a solid foundation and uniform mass to receive the superincumbent structure. The sides and watertight transverse bulkheads are formed of boiler plates rivetted together, and strengthened by vertical and horizontal ribs or frames of ordinary angle and T iron; the whole being united to the bottom by means of strong angle irons and knees, or strengthening pieces; and the sides throughout being braced together by means of iron plates, and beams of iron and timber, so as to form one combined structure. During or after the construction of the framework of the caisson, which may be done in any convenient harbour or sheltered place, the sides, ends, and bulkheads are to be stayed by strong walls, built within the sides, longitudinally and transversely, and bonded with the ribs, beams, and tie-plates, to give general stiffness. At this stage, the caisson may be floated to the site and there sunk, when it will at once constitute a solid foundation and material part of the permanent work. The part of my invention applicable to floors and foundations, consists in applying arrangements of plates, and filling in of the cells or spaces formed by them (similar to those already described for the bottom of the caisson) to the construction of flooring, such as floors of warehouses or other buildings, and the bottoms of locks and other cases where great strength may be required."

[If all patentees would follow Mr. Beardmore's example and publish their specifications and drawings in a cheap form, they would confer a great favour on their brother inventors. We fear, however, that, in many cases, their deeds will not bear the light.—Ed. *Artizan.*]

Joseph Clinton Robertson, of Fleet-street, London, civil engineer, *for improvements in the manufacture of gas.* Patent dated July 6, 1848.

The invention claimed under this patent relates, firstly, to manufacturing gas for illumination from resin, combined with alkaline and vegetable fibrous substances, subjecting them to heat in a retort; and then passing the gaseous or volatile products of this distillation through other retorts, containing lumps of coke, broken bricks, or other similar substances in a fragmental and incandescent state. Secondly, the separation and collection of oil or oleaginous matters from the volatile or gaseous products of the first distillation. Thirdly, the manufacture from the oil or oleaginous matters of an anti-friction grease, by mixing it with lime and granulated zinc. Fourthly, the manufacture of a spirit from the above described products, which may be used for illumination, or when rectified, for varnishes.

William Edward Newton, of Chancery-lane, Middlesex, *for improvements in the construction of stoves, grates, furnaces, or fire-places, for various useful purposes.* Patent dated July 6, 1848.

This invention consists in a method of supplying air to stoves in such a manner that it shall be heated, and the products of combustion intimately mixed with it, to assist their mutual combustion. Under this patent is claimed, First, the combination of the chamber of combustion (in which the fuel is consumed) with a heating chamber, for effecting the combustion and circulation of the inflammable matters, evolved from the combustion of the fuel, by means of a throat, through which such products of combustion pass. Secondly, admitting atmospheric air into this throat for the purpose of combining with such products. Thirdly, forming the lower aperture of the throat larger than the upper aperture for the better combination of the air and the products of combustion. Fourthly, forming the throat of an enlarged size between the lower and upper apertures.

John Martin, of Killyleagh Mills, in the county of Down, Ireland, manufacturer, *for improvements in preparing and dressing flax, tow, and other fibrous substances, and doubling, drawing, and twisting flax, tow, and other fibrous substances, and in the machinery to be used for such purposes.* Patent dated July 6, 1848.

This invention is thus summed up in the claims of the patentee:—First, for applying a series of revolving cutters for the purpose of sharpening the teeth or wires of cards placed upon a cylinder used for carding tow and other fibrous substances requiring such preparatory process. Also, the mode described of arranging and combining apparatus for facilitating the removal of dirt and other extraneous matters from the fibrous substances under the carding operation; secondly, the mode of arranging and constructing hackle stocks in cocks, and causing them to be moved out by strikers, and the mode of continuing the hackles in action as described, as also the mode described of arranging and constructing apparatus which is in combination with fixed receivers, for the purpose of ensuring the correct traversing of the holders. Also, the arranging and working a rake apparatus for the removal of the tow as described, as also the mode described of arranging and constructing a cam-apparatus for the purpose of governing the descent of the flax, and by which means the several holders may descend with different speeds, and the speed of each of the holders varied. Also the mode described of arranging and constructing apparatus for actuating the holders, so that the movements of the several holders are made independent of each other, and that they can be made to move at various velocities, or at velocities different from each other. Thirdly, the mode described of effecting the application of steam to flax, hemp, and tow, during the time of passing through a drawing process. Fourthly, the mode described of varying the drag on the bobbins, employed in the spinning of flax, hemp, and tow.

George Beattie, of Edinburgh, builder, *for an improved air-spring and atmospheric resisting power.* Patent dated July 6, 1848.

The improved air-spring consists of one or two cylinders (according as the door is required to open one or both ways) fitted with pistons and rods, acted upon by a toothed segment, attached to the door, taking into a rack on the piston rod. Part of the segment is plain to admit of it acting upon only the one cylinder required. On the door being opened, one of the pistons will be raised and a vacuum formed underneath, the pressure of the atmosphere on which, will tend to close the door. A valve at the bottom of the cylinder, opening outwards, allows any leakage of air to escape when the piston returns to the bottom of the cylinder. The same principle is applied to buffing apparatus by having two pistons on one rod and working in two cylinders, in one of which the air is compressed, and in the other a vacuum created by the action of the apparatus. A similar arrangement is proposed but with the pistons coming into action successively.

Walter Orbell Palmer, of Southacre, Swaffham, Norfolk, farmer, *for improvements in machinery for threshing and dressing corn.* Patent dated July 10, 1848.

This invention consists in combining with a threshing machine, apparatus for dressing and cleansing the corn. The straw is shaken after being threshed as usual, and the corn is carried by an endless band and chain of buckets, into a riddle, which separates the short straw, the corn falling through into an ordinary dressing machine. The inventor claims the combination described, and the application of the riddle.

Chevalier Alexandre Edouard Le Molt, of Conduit-street, Middlesex, *for certain improvements in apparatus for lighting by electricity; parts of which may be made of in other applications of electricity.* Patent dated July 20, 1848.

There is but little in this invention which can be said to be new. The patentee proposes to use carbon as one of the elements in a voltaic battery, and for this purpose employs the carbonaceous matter deposited in gas retorts, either in its crude state, or ground and mixed with coal-dust and tar, and compressed into a cake of the proper form. The carbon elements are to be electrotyped at each end to allow of their being connected with the other elements, parts of which are to be protected with varnish so as to preserve them from being acted upon by the acid uselessly. The apparatus for the production of the electric light consists of two carbon electrodes, of a disc shape, and mounted on spindles in two arms, which are jointed at bottom to allow of lateral motion. These discs are made to revolve by clock-work, and are brought together, as they are worn by the electric fluid, by a spring. This motion is regulated by a cam, worked off the clock-work, which has recesses, in number proportional to the time which the light is to remain without attention, and into these recesses pins on the electrode levers fall, as the cam revolves, and allow the electrodes to approach each other.

Joseph Stenson, of Northampton, engineer, *for improvements in steam engines and boilers, part of which improvements are also applicable to other motive machinery.* Patent dated July 18, 1848.

The first part of this improvement consists of a rotary engine formed of two cylinders, placed eccentrically, a diaphragm sliding in and out to form the steam abutment. The principal novelty consists of an arrangement in which the stuffing-box ordinarily used in such engines for the main shaft is dispensed with, by having a crank and crank-pin on the shaft, the pin working in the revolving piston and an opening being left in the end plate of the casing for the shaft to pass through. An arrangement with a stuffing-box is also described. The second part consists of a rotary emission engine, in which two wheels are placed on one shaft, but revolving in opposite directions, the face of the wheels being provided with indentations, so that the steam issuing from one wheel reacts upon the other, and *vice versa.* The third part consists in adapting guides to the piston cross-head of oscillating engines to obviate the necessity of having deep stuffing-boxes. The fourth part consists in various improved forms of boilers. One of these is formed of two concentric vertical cylinders with a water space between; the inner cylinder, which is shorter than the other, forms the fire-box, and the fire-bars are set radially inside of it. In the centre of this fire-box, is a small cylinder, the top of which is connected with the upper water space by a few vertical water-tubes, and communicating by a a horizontal pipe with the lower water space; another arrangement consists of the vertical fire-tube boiler, as described in previous volumes of the "*Artizan,*" but having the outer casing carried up beyond the upper tube-plate, forming a steam-dome round the smoke-box and chimney; the object of this arrangement being to obtain sufficient steam-room. Another arrangement is described, consisting of a cylindrical boiler, with a tube through it, set horizontally, with the fire underneath. Inside this tube is placed another tube or generator, containing water, with a flue-tube through it. This generator is connected to the upper part of the boiler at the furnace end, and to the bottom water space at the other end. The draft passes under the bottom of the shell of the boiler, then through the large tube, and outside the generator, and then through the generator into the chimney-flue. A self-acting damper is described, in which the pressure of the steam acts upon a small piston in a cylinder on the top of the boiler, and raises a series of weights in succession, closing the damper by its action as the pressure increases. An apparatus is described by which the steam in condensing engines, is made to heat the feed-water, the feed pipe being coiled inside a continuation of the exhaust-pipe. In another arrangement, the steam is passed through a set of tubes, which are to be exposed to a current of cold air, by being placed in a situation where all the air drawn through the boiler furnace has to pass over them. A new form of condenser is described, in which the injection water passes through a perforated plate at the top of the condenser. Beneath the condenser are two chambers provided with slide-valves, into which the injection-water will fall by its own gravity when the valves are opened; the lower of the two chambers is also fitted with a steam-pipe, by which a small quantity of steam is admitted, and the water blown out into a hot-well. The patentee says that a small air-pump *may* be applied to get rid of the air. The application of two vertical boilers to locomotives is also claimed, a plan recommended long ago in this journal, and of which a drawing will be found in the *Artizan,* June 1846. A method of surrounding the gauge-cock pipes with perforated cylinders to prevent sudden fluctuation of the apparent water level, and of bolting steam-pipes together to prevent accidents, is described. Also, the using the steam from a cooking apparatus to turn the spits—a method of employing an air-engine in order to remove the steam-engine from the building where the power is required, and of obtaining electric light from the steam issuing from an emission-wheel.

Jesse Ross, of Leicester, agent, *for improvements in apparatus for dibbling, and other agricultural purposes, part of which improvements are applicable to propelling vessels.* Patent dated July 11, 1848.

The claims are—First, the arrangement and combination of the apparatus for dibbling and sowing by one operation of the machine. Secondly, the application of the said apparatus to a machine drawn by horses, and acted upon by cranks and rods. Thirdly, the application of the principle of this arrangement to working a series of vertical paddles in such a manner that the edges of the floats shall be presented to the water as they are withdrawn; the paddles at the stern being driven at a greater speed than those in the forepart of the boat.

Leon Castellain, of Poulton-square, Middlesex, chemist, *for improvements in the manufacture of soap.* Patent dated July 11, 1848.

These improvements consist in mixing Irish moss and sea salt with the soap.

William Edward Newton, of Chancery-lane, Middlesex, *for certain improvements in machinery for letter-press printing.* Patent dated July 18, 1848.

The first part of this invention relates to an improved method of supplying and distributing the ink in a cylinder printing machine, and consists in dividing the laying on and taking up of the ink, between the distributing surface and the inking rollers, into four or more operations, the great object being to distribute tbe ink as evenly as possible. Several methods of construction are described under this head. Another improvement consists in so adapting two sets of type upon one cylinder and arranging the details, that they shall print the two sides of the paper in one machine. Another improvement consists in an apparatus called a flying-sheet frame, by which the sheets of paper are piled in regular order as they leave the machine. This is effected by a frame placed in a vertical position at one end of the receiving table, jointed at the bottom, and connected to the machine in such a way, that when the sheet of paper is brought exactly before it by the tapes, the frame will be suddenly depressed to a horizontal position, describing a quarter circle, and carrying the paper with it on to the table. The second part relates to a method of combining the levers and toggle joint in a hand printing press, and to the application of self-acting ink apparatus to hand machines. An improved card printing press is also described, in which the type is inked by self-acting apparatus. The type being placed vertically, the cards are supplied from a box over, and are pushed down by a thin plate through a slot in the bottom of the box, and after the printing has been effected, the card is allowed to fall into a receiving box below. The machine is worked by the foot of the workman acting on a treadle, thus leaving his hands at liberty.

Richard Roberts, of the Globe Works, Manchester, engineer, *for certain improvements in and applicable to clocks and other time-keepers, in machinery or apparatus for winding clocks and other hoisting weights, and for effecting telegraphic communications between distant clocks and places otherwise than by electro-magnetism.* Patent dated July 11, 1848.

The specification of this invention which occupies eighteen skins of parchment, and eight sheets of drawings, is of such great length, and of so complicated a nature as to prevent us from devoting to it more of our space than is sufficient to give the claims, which are as follows:—

1. An arrangement and combination of apparatus, whereby tidal power is rendered applicable in effecting the motion of clock-work, and other machinery.
2. An arrangement for driving the striking and going hand from one spring or weight, and for overcoming the difficulty of the guide-pulley in turret and other clocks.
3. A mode of causing the time indicated upon the dial of one clock to be indicated simultaneously upon a number of dials placed at a distance, and its application to purposes of telegraphic communication.
4. An arrangement for imparting equimotive impulses to timekeepers.
5. A method of causing the hand or index to move a distance corresponding to the number of oscillations of the pendulums.
6. A combination whereby pocket and box chronometers are made to beat dead seconds.
7. An arrangement for recording the duration of an occurrence without interfering with the other movements of the time-keeper.
8. Certain improvements in the compensating balances of chronometers.
9. A cycloramic dial. (The dial and hand both transparent.)
10. The employment of toothed sectors for effecting striking in clocks.
11. A chronometer with equimotive escapements, whereby its mechanism is made to act with greater accuracy.
12. A mode of hardening and manufacturing the dials of time-keepers.
13. A normal drill.
14. A guage for ascertaining the sizes of the different parts of time-keepers.

Anthony Lorimier, of Bell's-buildings, Salisbury-square, City, bookbinder, *for improvements in combining gutta percha with caoutchouc and other materials.* Patent dated July 10, 1848.

The first part of this invention consists in a method of cleansing gutta percha, which is effected by cutting it into shavings, which are passed through a cylinder studded with spikes, and having another spiked cylinder revolving in it. By this means all the dirt will be shaken off and will fall through a sieve at bottom. The gutta percha is then to be passed through a welding machine, as the patentee calls it, or more properly, a mixing machine, consisting of spiked cylinders as before described, but heated with a steam jacket, by which the gutta percha will be worked up; it is finally passed through kneading rollers. The improved combination consists in mixing with it burnt flint or powdered stone, oxide of copper, or of zinc, &c., which may be added to it in the mixing machine, or be rolled into sheets of it on a hot table. Caoutchouc may be combined with similar materials to form a waterproof material.

Charles Purnell, of Liverpool, dockmaster, *for certain improved apparatus to be applied to vessels laden with timber and other materials, the specific gravity of which is lighter than water, preventing the necessity of abandoning them at sea, by ridding them of the superincumbent water, and enabling them thereby to carry sail.* Patent dated July 18, 1848.

This invention consists in applying tanks in the hold of a vessel, with valves opening outwards, in such a way that when the vessel rolls to starboard, the tanks on that side will fill, and on the roll to larboard, will empty themselves, and *vice versa;* by this means the hold will be cleared of water.

[This is a very old friend indeed, in a new dress; a similar scheme has been applied to pump air out of the hold, by having two tanks partially filled with water, and fitted with air pipes and valves.—Ed. *Artizan.*]

William Swain, of Pembridge, Hereford, brickmaker, *for certain improvements in kilns for burning bricks, tiles, and other earthen substances.* Patent dated July 18, 1848.

The main features of this invention are, the fitting various doors to an ordinary kiln, such as a door to supply fuel, a door to rake the fire, a damper to the ash-pit, and air-tubes over the fire-bars, the object being to admit only just so much air as is sufficient for the combustion, and to have the fires completely under control.

Joham Arnold Steinkamp, of Leicester-street, Leicester-square, *for improvements in the manufacture of sugar from the cane.* Patent dated July 18, 1848.

These improvements consist in adding to the sugar a mixture of chalk and starch, in the proportion of one or two pounds of chalk, and half a pound of starch to 1,000lbs. of raw sugar. The whole is boiled with about 500lbs. water, skimmed and strained, and then filtered through cotton or other vegetable fibrous substances cut into short lengths.

William Edward Hollands, of 73, Regent Quadrant, in the county of Middlesex, dentist, and Nicholas Whitaker Green, of 15, Walton-place, Chelsea, gentleman, *for a new manufacture of artificial fuel, in blocks or lumps.* Patent dated September 4, 1848.

This invention consists in forming artificial fuel, which shall resemble natural coal in hardness and compactness. This is effected by mixing with the small coal, plaster of Paris, lime, and water, in such proportions as to form a hard concrete, which is compressed into blocks and dried. The patentees propose to add nitrate of potash, or similar substances, in small quantities to assist the inflammability by supplying oxygen; alum and rock salt may also be added to make a more lasting fuel. The blocks are to be finally coated with linseed or other oil, to protect them from the moisture of the atmosphere.

AMERICAN PATENTS.

EXTRACTED FROM THE JOURNAL OF THE FRANKLIN INSTITUTE.

For an improvement in stores, counting-rooms, &c., for preserving property in case of fire. R. D. Curtiss, Erie, Pennsylvania. February 15.

The patentee says—"My invention consists in providing offices, stores, &c., with door and railway, with the counting-room shelves, counter, &c., and the springs, levers, bars, catches, pulleys, cylinders, chain, cords, &c., by which the whole is rendered, in case of fire, self-acting, for the purpose of removing goods, records, money, &c., out of the building."

For an improvement in machines for roping bales of goods. R. Dillon, City of New York. February 22.

The patentee says—"The nature of my invention consists in providing machinery, to be operated by steam or other power, as an aid in roping up bales of cotton and other goods. Claim.—What I claim as my invention, and desire to secure by letters patent, is the peculiar combination of the sheaves with the ropes and tongs, applied for the purpose of roping up bales of goods in the manner herein set forth."

LIST OF PATENTS.

From the 13th Day of April, to the 3rd Day of May, 1849,

Gaspard Brandt, of Little Gray's Inn Lane, in the county of Middlesex, machinist, for improvements in the construction of the bearings of railway engines, and railway and other carriages now in use. Patent dated April 13; six months.

James Childs, of Earl's Court Road, Old Brompton, wax bleacher, for improvements in the manufacture of candles, night lights, and candle lamps. Patent dated April 16; six months.

Thomas Cocksey, of Little Bolton, Lancaster, millwright, and James Nightingale, of Breightmet, bleacher, for certain machinery to facilitate the washing and cleansing of cotton and other fabrics, which machinery is applicable to certain operations in bleaching, dyeing, printing, and sizeing warps and piece goods. Patent dated April 16; six months.

Louis Prosper Nicolas Duval Piron, engineer, of Paris, for certain improvements in tubes, pipes, flags, kerbs for pavements and tram roads. Patent dated April 16; six months.

Charles Shepherd, of Leadenhall-street, chronometer maker, for certain improvements in working clocks and other time-keepers, telegraphs, and machinery, by electricity. Patent dated April 16; six months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, in the county of Lancaster, manufacturers, for certain improvements in looms for weaving. Patent dated April 16; six months.

John Ruthven, engineer, Edinburgh, for improvements in preserving lives and property from water and fire; and in producing pressure, for various useful purposes. Patent dated April 16; six months.

William Henry Phillips, of York-terrace Camberwell New-road, in the county of Surrey, for improvements in extinguishing fire; in the preparation of materials to be used for that purpose; and improvements to assist in saving life and property. Patent dated April 16; six months.

William Little, of 198, Strand, in the county of Middlesex, for improvements in the manufacture of materials for lubricating machinery. Patent dated April 16; six months.—(Communication.)

Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for the manufacture of net lace, or other similar fabrics. Patent dated April 16; six months.—(Communication.)

William Hyde Knapp, of Long-lane, Borough of Southwark, chemist, for improvements in preparing wood for the purposes of matches and fire-wood. Patent dated April 17; six months.

Thomas Nicholas Greening, of the firm of Messrs. Burdekins and Greening, of Sheffield, cutlery manufacturers, for improvements in knives and forks. Patent dated April 17; six months.

Alexander Alliott, of Lenton Works, in the county of Nottingham, bleacher, for improvements in apparatus for ascertaining, and for marking or registering the force or pressure of wind, of water, and of steam; the weight of goods or substances; and the velocity of carriages; also in apparatus for ascertaining, under certain circumstances, the length of time elapsed after carriages have passed any given place; and for enabling the place or direction of floating bodies to be ascertained. Patent dated April 17; six months.

George Remington, of Warkworth, Northumberland, civil engineer, for certain improvements in locomotive, marine, and stationary steam engines; and in hydraulic and pneumatic engines. Patent dated April 17; six months.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in boilers or steam generators. Patent dated April 17; six months.—(Communication.)

Henry Bessemer, of Baxter House, in the county of Middlesex, engineer, for improvements in the methods of extracting saccharine juices from the sugar cane, and in the manufacture of sugar, as also in the machinery or apparatus employed therein. Patent dated April 17; six months.

John Ormerod, of Holt Holme Hill, near Newchurch, Lancaster, spinner, for certain improvements in carding cotton and other fibrous substances. Patent dated April 19; six months.

Robert Gordon, of Heaton Morris, in the county of Lancaster, engineer, for certain improvements in the ventilation of mines. Patent dated April 19; six months.

N.B.—This patent being opposed at the Great Seal, was not sealed till the 19th, but bears date the 4th April, instant, the day it would have been sealed but for the said opposition.

Charles Alexander Broquette, of Rue Neuve St. Nicholas St. Martin, in the Republic of France, chemist, for improvements in printing and dyeing fibrous and other materials. Patent dated April 21; six months.

William Kilner, of Sheffield, in the county of York, engraver, for improvements in manufacturing railway and other axles and wheels, and in machinery to be employed in such manufacture. Patent dated April 24; six months.

Lewis Vernet, of Buenos Ayres, for a method of preserving from destruction by worms, insects, decay, and fire, certain vegetable and animal substances. Patent dated April 24; six months.

Thomas Harcourt Thompson, of Blackheath-hill, civil engineer, for certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places; and in apparatus and machinery for regulating the levels of waters in rivers, reservoirs, and canals. Patent dated April 26; six months.

George Simpson, of Newington-butts, chemist, and Thomas Forster, of Streatham, manufacturer, for improvements in manufacturing or treating solvents of india-rubber, and of other gums or substances. Patent dated April 26; six months.

John Barsham, of Chelmsford, in the county of Essex, manufacturer, for improvements in separating the fibre from cocoa-nut husks. Patent dated April 26; six months.

Charles Iles, of Bordesley Works, Birmingham, machinist, for improvements in manufacturing picture-frames, inkstands, and other articles in dies or moulds; also in producing ornamental surfaces. Patent dated April 26; six months.

William Faulconbridge, of Long-lane, Bermondsey, in the county of Surrey, for improvements in the manufacture of hose-pipes, driving-bands, and valves for atmospheric railways. Patent dated April 26; six months.

Bartholomew Beniowski, of Bow-street, Covent Garden, Major in the late Polish Army, for improvements in the apparatus for, and process of, printing. Patent dated April 26; six months.

Robert Oxland, of Plymouth, chemist, and John Oxland of the same place, chemist, for improvements in the manufacture of sugar. Patent dated April 26; six months.

William Henry Burke, of Tottenham, manufacturer, for improvements in the manufacture of air-proof and water-proof fabrics; and in the preparation of caoutchouc and gutta percha, either alone or in combination with other materials, the same being applicable to articles of wearing apparel, bands, straps, and other similar useful purposes. Patent dated April 26; six months.

John Horsley, of Ryde, in the Isle of Wight, practical chemist, for certain improvements in preventing incrustation in steam and other boilers; also for purifying, filtering, and otherwise rendering water fit for drinkable puposes. Patent dated April 26; six months.

Alphonse Garnier, late of Paris, in the Republic of France. but now of South-street, Finsbury, merchant, for certain improvements in extracting and preparing colouring matter from orchil. Patent dated April 26; six months.—(Communication.)

James Wilson, of Old Bond-street, tailor, for improvements in trusses. Patent dated May 1; six months.

James Godfrey Wilson, of Millman's-row, Chelsea, engineer, for certain improvements in the manufacture of glass, and in machinery and apparatus connected therewith. Patent dated May 1; six months.

Alexander Munkiltritch, of Manchester, merchant, for an improved composition of matter, which is applicable as a substitute for oil, for the lubrication of machinery, and for other purposes. Patent dated May 1; six months.—(Communication.)

William Newton, of Chancery-lane, civil engineer, for improvements in the jacquard machine. Patent dated May 5; six months.—(Communication.)

George Edmund Donisthorpe and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and hackling fibrous matters. Patent dated May 8; six months.

Samuel Wilkes, of Wednesfield Heath, near Wolverhampton, brass-founder, for improvements in the manufacture of knobs, handles, and spindles for the same, for doors and other purposes; and improvements in locks. Patent dated May 8; six months.

Robert Sutcliffe, of Idle, near Bradford, in the county of York, cotton spinner, for improvements in machinery for spinning cotton, silk, and other fibrous substances. Patent dated May 8; six months.

George Henry Dodge, citizen of the United States of America, now residing at Manchester, manufacturer, for certain improvements in machinery for spinning and doubling cotton yarns, and other fibrous materials; and in machinery or apparatus for winding, reeling, balling, and spooling such substances when spun. Patent dated May 10; six months.

Charlotte Smith, wife of Jabez Smith, of Bedford, in the county of Bedford, for improvements in certain articles of wearing apparel. Patent dated May 14; six months.

Samuel Allport, of Birmingham, gun maker, for a certain improved method of making or manufacturing a certain part or parts of looms used in weaving. Patent dated May 14; six months.

William Phillips Parker, of Lime-street, in the city of London, gentleman, for improvements in the construction of pianofortes. Patent dated May 15; six months.—(Communication.)

John Thorn, of Ardwich, near Manchester, calico-printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics, and yarns, and in dying fabrics and yarns when printed. Patent dated May 15; six months.

Henry Bessemer, of Baxter House, Old St. Pancras-road, engineer, and John Sharp Cromartie Heywood, of Islington, both in the county of Middlesex, for improvements in expressing and treating oils, and in the manufacture of varnishes, pigments, and paints. Patent dated May 15; six months.

Moses Poole, of the city of London, gentleman, for improvements in apparatus for drawing fluids from the human or animal body. Patent dated May 15; six months.—(Communication.)

Louis Alfred Chatanvillard, of Rue St. Lazare, in the republic of France, gentleman, for improvements in fire-arms, cartridges, bullets, bayonets, and ordnance. Patent dated May 15; six months.—(Communication.)

John Dalton, of Hollingworth, in the county of Chester, calico printer, for a certain improvement, or certain improvements, in printing calicos and other surfaces. Patent dated May 1; six months.

Samson Waller, of Bradford, in the county of York, manufacturer, for certain improvements in machinery or apparatus for weaving. Patent dated May 3; six months.

Thomas Wentworth Buller, of Sussex-gardens, Hyde-park, esquire, for improvements in the manufacture of earthenware. Patent dated May 3; six months.

Matthew Kennedy, of Manchester, cotton-spinner, for certain improvements in the method of packing "cops" of cotton, and other fibrous materials, and in the apparatus connected therewith. Patent dated May 3; six months.

Thomas Whaley, of Chorley, in the county of Lancaster, coal proprietor, and Richard Ashton Lightoller, of the same place, cotton spinner, for certain improvements in machinery or apparatus for manufacturing bricks and tiles. Patent dated May 3; six months.

THE PATENT LAWS AND THEIR REFORM.

(Continued from p. 110.)

The statute of monopolies, although it effected a vast improvement in the crude and uncertain system then existing, yet did nothing more than lay the mere foundation of the patent laws; and the law and practice, but especially the latter, was still found wanting in many important particulars. As it still stood, it made no provision for the revelation of the secret to the world on the expiration of the term of privilege and property therein, it being required that the invention be disclosed to the crown, or its officers only, who were not obliged again to disclose it the public; and in cases of inventions of very great and general importance, it was sometimes introduced as a proviso in the patent, that the inventor should *take apprentices* to learn the practice of the invention. This system had likewise the defect of not affording exact and sufficient evidence as to the nature and extent of the invention, leaving it open on the one hand, for the inventor to claim more than that for which he obtained his patent, and on the other, to the chance of infringement through ignorance.

In the reign of Queen Anne, this defect was seen in its true light; and by way of remedy, a proviso, inserted in the letters patent, requiring the enrolment of an "instrument in writing" under the inventor's "hand and seal," which should particularly describe, and ascertain the nature of the said invention, in what manner the same is to be performed, now commonly termed the *specification.* This, be it noted, was effected without the aid of Parliament, and was, without doubt, a most judicious and worthy use of the royal prerogative.

No further change occurs in the law or practice of patents for inventions until we come to recent times. In the year 1835, the bill brought in by Lord Brougham, for the amendment of the patent law was passed, which effected some important changes and amendments. Permitting a patentee who had deposited a defective or erroneous specification of his invention to disclaim or amend the erroneous portion under certain restrictions; authorising the confirmation of a grant, void at law for want of novelty, under particular circumstances; making a verdict in favour of a patentee to entitle him in future cases to treble costs; allowing prolongations to be conceded in peculiar cases; making a specific notice of the objections intended to be raised against a patent necessary in all legal proceedings; and imposing a penalty of £50 for the unauthorised use of the name of a patentee.

It follows from the foregoing, that the existing law of letters patent for inventions consists of the statute of monopolies, together with the common law of which it is declaratory, where that is not repugnant to the statute, the Patent Law Amendment Acts (Lord Brougham's), and the provisos of the patent itself.

The first of these, it will be seen, merely amounts to a saving clause in favour of the grant of monopoly patents for *new inventions* for *any manner of new manufactures,* but does not enact any positive and definite law, except the limitation of the duration of such patents to *fourteen years.* The nature and extent of the protection to be afforded by the letters patent is in no way defined by it; and thus we are thrown back upon the common law, which is to be gathered from the recognised text-books, and the provisos of the letters patent, together with Lord Brougham's Acts, which, however, refer only to peculiar cases.

Much has been said by many persons with regard to the vague definition given by the law as to the subject matter of letters patent for inventions; but this has little foundation, for nothing can be more certain and comprehensive than the definition in the statute of James the First, which requires the subject matter of letters patent to be any manner of *new manufactures,* and to ascertain the law we have only to ascertain the interpretation of the words, "*new manufactures.*"

F. W. Campin.

(To be continued.)

THE SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Tuesday, May 1, *and May* 8, 1849.

Joshua Field, Esq., President, in the Chair.

At the first of these meetings, the monthly ballot took place, when the following candidates were elected:—W. Wilson and R. Peacock, as members; and W. E. Bott, W. Sowerby, jun., and Capt. H. James, R.E., as Associates.—The discussion on Mr. Crampton's paper, "On the construction of Locomotive Engines," was continued through both these evenings. The same tone of argument was kept up, and numerous instances were adduced supporting the views of both sides; but without arriving at any definite result, other than that it was desirable in all engines to lower the centre of gravity, in order to establish a great angle of stability, and to arrive at a ratio between the circumference of the driving-wheel and the cubic content of the cylinders, such as whilst the greatest speed might be maintained, with an economical consumption of fuel, every facility should be afforded for starting rapidly, which was a point of importance on lines running frequent trains. On the one hand it was argued, that small driving-wheels were essential for quick starting; and on the other hand it was contended, that with a given amount of evaporating surface in the boiler, the tractive power would be the same under all circumstances at the periphery of the driving-wheel, provided a given relative proportion existed between the cubic content of the cylinder and the circumference of the driving-wheel, and that large wheels reduced the wear and tear.

The long disposed of question of the stability of the long boiler engines was again cursorily touched on and disposed of.

The diminution of the wear and tear of the sides of the brasses of the

engines, having the driving-wheels behind, and the greatest weight upon the extremities, leaving a comparatively light load on the centre wheels, was adduced as a proof of their stability, an engine of that kind having run twenty-five thousand miles without any appreciable lateral wear; whereas an ordinary engine on the same railway, had worn away a thickness of a quarter of an inch whilst running the same distance.

A short paper was read, describing a kind of permanent way, which had been somewhat extensively laid down on the Lancashire and Yorkshire and other railways, in the north of England, by Mr. Hawkshaw, M. Inst. C.E. The principle was that of a bridge rail, weighing seventy-five pounds per yard, placed upon continuous longitudinal timber bearing, and the novelty consisted in having at each joint a malleable iron plate chair, with a projection on the upper surface, fitting within the interior of the rail, and the flanches, which were fourteen inches long by eight inches wide, and half an inch in thickness, attached to the rail by rivets in such a manner as to fix them firmly together, and yet to allow for the expansion and contraction caused by the variations of temperature. The details of the arrangement were very simple and complete, and it appeared to succeed perfectly, as in an extent of twenty miles of railway so laid, over which numerous heavy trains had ran daily at a considerable speed, for the last year, only three heads were found to rivet have been knocked off when recently examined.

The paper announced to be read at the next meeting of Tuesday, May 15th, was "On the Theory of Transverse Strain of Cast-iron Beams," by W. T. Doyne, Assoc. Inst. C.E.

The President invited the Members and Visitors to contribute and to procure Models for exhibition, at the Annual Conversazione, which was announced for Tuesday, May 22nd.

Tuesday, May, 15, 1849.

JOSHUA FIELD, ESQ., President, in the Chair.

THE discussion on Mr. Hawkshaw's paper, "On a longitudinal continuous bearing permanent way," was continued throughout the evening, to the exclusion of every other subject. Some interesting observations were made on the actual destruction of the cast-iron chairs and double-headed rails, and the advantages that would result from the more general substitution of continuous longitudinal timber bearings for the present transverse sleepers and cast-iron chairs. The gradual ameliorations that had taken place in the forms and strengths of the bridge rails and their various fastenings were discussed; and it was contended that the hollow bridge rail was more durable than any other, that the upper surface was more compressed in rolling, and that the system of connecting the end, whether by rivetting to a plate, or by bolts and nuts, made a better and more even joint, and therefore produced a more level surface for the engines and carriages to run upon. The duration of the timber was declared to be such, that a second set of bridge rails had been laid down on the longitudinal timbers, whereas the cross sleepers had never been able to bear that. This, however, it was asserted, arose principally from common timber being used for the transverse sleepers, whilst the best kind, well creosoted, was used for the longitudinal bearers.

The system of inserting a piece of hard wood between the rail and the main timber, as on the Great Western Railway, was much approved, as was also the plan of side transoms halved into the main timbers, as it enabled a better system of drainage to be employed than had been usual with that kind of permanent way.

The new systems tried by Mr. Samuels on the Eastern Counties Railway, and of which several models were exhibited and described, received much commendation, particularly the plan for dispensing with the joint chairs, and uniting the ends of the rails by two side pieces, or fishes, of cast-iron, bolted through and to each other, so as to render that part quite equal in strength to the body of the rail. The question of the means of allowing for the contraction and expansion of a line of securely fastened rails, was discussed, as was the creeping or advancing motion of rails in the direction of the traffic.

The general opinion seemed to be decidedly in favour of the longitudinal bearing, although it was admitted that many of the transverse sleeper railways, for instance, such as had been laid on the plans of Cubitt and of Hawkshaw, were so good that it was not to be presumed they would be removed to make way for the longitudinal system.

The President reiterated an invitation to his Conversazione on Tuesday, May 22nd.,—for which he requested good models and works of art—and the meeting adjourned until June 5th, when the Monthly Ballot for Members will take place, and Mr. Howard's paper "On the method of Rolling the Links of the Chains of Suspension Bridges," will be read.

PRESIDENT'S CONVERZATIONE—*Tuesday, May* 22, 1849.

MR. FIELD, the President of the Institution, held his Annual Conversazione on Tuesday evening, May 22nd.

The entertainment of the evening was not restricted to the intellectual faculties, for the refreshment rooms appeared to have been equally well attended to, and certainly attracted as much attention as the models. The visitors were most numerous, and at one time the rooms appeared filled to repletion; but the ventilation was so perfect that the heat was not overpowering, and the profusion of flowers in every direction "wafted only sweet odours."

From such a large collection we can only particularise a few, and we must give the place of honour to the works of art. On the walls were the portraits of the celebrated engineers, Locke, Brunel, Fairbairn, and Mr. Isambard Brunel, by Grant, Hornby, and Patten. Around the walls and on the tables were beautiful specimens of the pencils of Etty, Haghe, Lee, Fahey, Scanlan, Pitt, Wood, Boxall, Richmond, Jutsum, Forrester, and many others.

Mr. Thomas contributed a beautiful marble chimney-piece, intended for Mr. Peto, and a statuette of Ariel commanding the Storm. Mr. Behnes also sent an excellent bust of Mr. C. Barry. Mr. Deighton's model of the Kneller Hall Training School was an excellent specimen of Mr. Mair's architectural skill and taste. Among the principal of Salter's models were, Mr. Fowler's New Holland Pier, and his Girder Bridge over the Trent; Mr. Jee's Dinting Vale Viaduct; Captain Moorsom's Viaduct on the Waterford Railway; Mr. G. Edwards' Bridge over the Waveney; Mr. Grainger's Bridge over the Calder; Mr. Stephenson's Tubular Bridge over the Menai Straits; and of the Bishop's Rock Pile Light House, erecting in a most perilous position, by Messrs. Walten and Burges. Cochrane's Sawing Machine excited great attention; as did Gordon's Cata-Dioptric arrangement, and Wilkin's Fourth Order Dioptric Light Apparatus.

The Earl of Rosse contributed the model of his beautiful Telescope, as did Mr. Cowper those of his own, Mr. Lassels', and Mr. Nasmyth's methods of mounting Equatorial instruments.

The Electric Telegraph Company had a fine collection of working instruments, and Messrs. Brett and Little contributed a series of theirs.

Mr. Strode's self-igniting gas-burner, and Mr. Biddell's self-regulating gas-burner, were both much admired.

Messrs. Adams exhibited a complete series of improvements in railway carriages, permanent way, &c.; and Messrs. Johnson and Cammell an equally complete assortment of steel springs, files, &c.

Mr. Roberts had a beautiful collection of models and working instruments, exhibiting his usual talent of invention and beauty of execution.

Messrs. Mitchell had a series of models of the various applications and mode of using the screw-pile and mooring. Very complete models were also shown, by Mr. Woods, of Clement's Sugar Refinery, and of a rotative dynamometer.

Messrs. James Wall and Co. sent two curious models of an engine with an oscillating cylinder, made by Murdock in 1785, and of a locomotive engine, by the same ingenious man, prior to 1784.

Messrs. Ransome and May exhibited some shavings of cast-iron, cut by tools of immense power, from railway wheels.

Messrs. Maudslay sent a model of a large gun, intended to be loaded and sponged by the breech; and a method of feathering paddles.

Messrs. Seaward and Co. contributed a series of models of plans for raising stern propellers; and Messrs. Chubb also sent a beautiful specimen of an iron chest, very superior in workmanship and design.

The examination of all these, and many other interesting objects which our space will not allow us to mention, afforded ample amusement to the guests; and it was not until an early hour of the morning that the last had departed, highly gratified with the President's hospitable reception.

SOCIETY OF ARTS.

April 27th.

T. WEBSTER, Esq., F.R.S., Vice-President, in the Chair.

A meeting for the consideration of the state of the laws affecting arts and manufactures, and the protection afforded to designs and inventions, took place.

The Chairman opened the business of the meeting by stating that the Council had appointed a special committee for the consideration of the above subject. It had also been thought desirable to call a meeting of the members of the Society, in order that the committee might have an opportunity of receiving from them such suggestions as they might be able to afford, in order to assist the committee in drawing up its report on so important a subject.

A letter from Mr. Henry Cole was read, in which he stated that he considers the patent laws, as they at present exist, defeat much of the object which they ought to promote, as the cost, with fees and agency, often act as a depressing tax on inventions, especially those of a comparatively temporary character; further, he considers that it ought not to be maintained that the cost of a patent should be viewed as a tax for the benefit of the community at large. The cost, though great, is, however, not the sole point to be reformed. There are—1st, the uncertainty which attaches to rights professedly conferred by patents, and the want of a declaratory law; 2ndly, there are difficulties, and delays, and obsolete forms, in the process of obtaining patents; 3rdly, the insecurity which is generated by the delays; 4thly, the difficulties and loss of time in searching for patents, and the want of methodical indexes; 5thly, the encouragement to piratical inventors which the present system fosters; 6thly, the cost of legal remedies for infringements, and the imperfect tribunal, affording what has been called "a lottery of justice;" 7thly, the many imperfections which arise out of the present system of specification; 8thly, the great and often insurmountable cost in obtaining an extension of a patent. Each and all of these hardships are rendered the more grievous by the large amount and risk of the first cost.

Mr. Prosser considered that the cost of obtaining a patent in England is much greater than it should be. The cost of obtaining patents in America, Austria, and France, is much less than in England; and the cheapness of obtaining patents in those countries is not found to increase litigation. He also considers that the specification should be deposited at the time the application for a patent is made. The Americans publish alphabetical lists of all patents granted. The French and Austrians print the specifications of all patents granted. These are things which he considers it would be well to have done in England.

Mr. W. Newton stated that he had been labouring for years to obtain an alteration in the patent laws, and had published a series of letters on the subject. He considers that if the cost of obtaining a patent for England were £60, for Scotland £20, and for Ireland £20, that such charges would be satisfactory. The act for the registration of non-ornamental designs, as it at present exists, is, he considers, not intelligible, and worse than useless.

Mr. W. E. Newton did not consider that patents for England, Scotland, and Ireland should be distinct, but should be granted under one seal, as for the United Kingdom. He did not agree with Mr. Prosser in thinking that the specification should be deposited at the time of applying for a patent.

Mr. Brockedon considered that the indexes of the patents granted should be published.

The Chairman stated that a society has been established for some time past, which has for its object the amendment of the patent laws, and, during the past year, through its instrumentality, all the enrolments have been effected at one office. He considered it would be very desirable to direct the efforts of this Committee to obtaining indexes of the patents granted, as it would be a great security to persons obtaining patents.

Mr. Newall and others having spoken upon the subject, the meeting adjourned till Thursday, the 10th May, at eight o'clock, to afford members an opportunity of considering the subject, and preparing suggestions.

PARIS ACADEMY OF SCIENCES.

ON THE MANUFACTURE OF SUGAR FROM POTATO STARCH, OR FECULA.

THE fabrication of sugar from fecula by means of sulphuric acid has been carried to a great extent in France; partly because the price of potato starch is usually very low, and partly because the starch syrup has received an extensive and varied application, viz.:—

1. For sweetening and strengthening wine. In a cask containing 50 gallons of wine, from 10 to 20 pounds of starch syrup are employed.
2. For brewing, especially for manufacturing a species of pale beer.
3. The distillation of brandy.
4. Manufacturing vinegar.
5. For adulterating raw cane sugar.

M. Payen has published an instructive article on this subject. It has been calculated that if the manufacturer consumes daily three tons of potato starch, and obtains therefrom 4½ tons of syrup, his daily profits amount to 55 francs=£2 4s. In one establishment the boiling is performed by means of steam; in another over the fire, in large leaden boilers placed on iron plates of a convex form, and of the thickness of 15 lines=1⅗ inch, in order to effect the gradual distribution of heat. One ton of water is first heated to the boiling point in these vessels, and 22 pounds of sulphuric acid of 60° Beaumé=1.845 (previously diluted with twice its weight of water) added to it. The vessel is provided with a wooden cover, coated with copper, which has, near the rim, an opening of about 12 or 15 inches in width, thus allowing the liquor to be stirred by means of a wooden spatula; and through which, after the liquor begins to boil, about 8 cwt. of starch flour is gradually sifted, continually stirring in quantities of about 1 lb. at a time; the formation of lumps is thus prevented, and the boiling uniformly continued.

In some of these manufactories the starch sugar, being mixed with water, is put into a vessel placed above the boiler, from which it flows into the boiling acid, in a uniform stream, by means of a tube; whereby the object sought—of a great quantity of the latter acting at once on a proportionately small portion of starch flour—is attained in a manner which admirably promotes the formation of sugar; and this operation is almost instantly effected as soon as the whole of the starch flour is carried down into the boiler; whilst, by the former way, according to which the whole of the starch was at once mixed with the liquor, the manufacturer was obliged to continue the boiling for 24 hours (repeatedly replacing the evaporated water.)

At present the boiling is continued for not more than eight or ten minutes after the whole of the starch flour has been brought into the acid liquor, in order to convert the contents of the boilers into syrup, and to obtain an almost transparent, very liquid solution; which, if tested with tincture of iodine, does not assume any violet colour; and which, if a sample be taken out, does not appear glutinous or lumpy. The fire is then regulated, so that the liquor ceases to boil; and this, in the event of the boiling being caused by steam, is managed by closing a tap. Chalk is then added in about the same proportion as the concentrated sulphuric acid; that is to say, 22 lbs. Since, however, the chalk is not always of the same quality, the point of perfect saturation must be ascertained by tincture of litmus; a small excess of chalk is not prejudicial, and even advantageous, in order to be sure that the free acid is entirely removed.

It scarcely requires the remark from us that the chalk should be added carefully and slowly, on account of the violent evolution of carbonic acid. The sulphate of lime produced (having deposited the liquor,) is strained through coarsely triturated burnt bones, which is spread on straining cloths in wooden filtering frames. The sulphate of lime which remains, is finally used as manure, being first washed with water; and this water is afterwards used for another process. The filtered liquor is gradually brought into a flat pan, in which it is evaporated rapidly, until it is reduced to about one half of its volume, and to a strength of 22° or 25° of Beaumé —1·176 to 1·205 specific gravity; after which it is, for the second t heated to boiling with charcoal and bullock's blood,—then fined and filtered. 100 parts of dry starch, or 150 of fresh, yielded 150 of syrup of 30° Beaumé = 1·256, equivalent to 100 parts of dry sugar, which is obtained by concentrating the syrup to 36° Beaumé = 1·324, decanting it into casks provided with taps, and slowly cooling it therein. At the expiration of two days, the liquid syrup may be obtained by opening the taps, and the crystallized sugar is then found in the casks. In some manufactories the syrup is concentrated to from 40° to 50° Beaumé = 1·375 to 1·510, and then decanted into tinned copper vessels, where the sugar, on

cooling, consolidates to a granular and compact mass, without assuming the form of regular crystals.

M. Payen states that two persons, relieving each other during the work, are able to boil five different quantities in 24 hours, and to consume 2000 kilogs. = nearly two tons of starch flour, if the work is conducted alternately in two boilers.

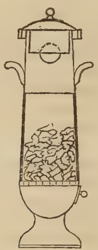
In Burgundy, particularly, a considerable quantity of starch syrup is consumed, for the purpose of giving more body to wine. In manufacturing spirits of wine, the starch sugar is to be preferred to the raw potato, enabling the distiller to obtain the spirit free from the empyreumatic oil with which it is otherwise contaminated. The sugar and syrup of fecula are also extensively applied to other purposes—for instance, sweetening made-dishes, confectionery, and manufacture of blacking.—*Patent Journal.*

ON STOVES AND FIRE-PLACES.

(Continued from p. 104.)

Having in our last No. given our readers a due warning of the danger resulting from the use of Portable Stoves" without chimneys, "Prepared Fuel," and such-like quackery, we will proceed to notice a variety of the "Stove Family," which bears as near, perhaps, as is safe, a Portable character. Before doing so, however, we may here answer several inquiries which have been addressed to us on the subject of the "Prepared Fuel," with the character of which we had presumed our readers were acquainted.

The idea of preparing charcoal in such a manner, that the carbonic acid gas, formed during its combustion, should be seized upon by some chemical agent, and rendered innocuous, originated, we believe, with a Mr. Joyce; and great expectations were formed of its success. The thing proved a failure; and we remember seeing a lot of these stoves sold at an auction for a mere song. The unlucky purchaser, however, had a dear bargain: one of the stoves was used in his own house, and the consequence was, that one, if not more members of his family, fell victims to the deadly effects of carbonic acid gas.



The stove, of which we have here given a cut, is one which we have used for three winters, and which has been found useful. It is composed of sheet iron, of a double thickness where the fire is most intense, and stands about three feet high. The fuel, coke or cinders, is put in at the top, which is provided with a sand joint, into which the cover dips, to prevent the escape of gas. The products of combustion pass through the pipe shown, which is continued by a bend, up the chimney of an ordinary fire-place. The short piece of pipe hanging down inside from the top, prevents any pieces of fuel from being thrown into the chimney, and tends to prevent the gas escaping into the room when fresh fuel is thrown on. The ash-pit is provided with a door, in which is an air-valve, by which the draught can be regulated.

This stove can be readily moved from room to room; and if the ash-pit door be well fitted, and the air-valve be screwed close, very little gas will escape during its removal. It has, however, some disadvantages. All the fuel being put in from the top, if the fire is not effectually lighted, the whole of the contents have to be removed by hand before it can be re-lighted. If not watched, too, it is apt to get red hot, when the body of coke is thoroughly alight; this renders it dangerous to hang linen, &c., near it, as people are apt to do, fancying, that because the fire cannot be seen, it can set nothing on fire. These objections could probably be overcome by lining the stove over the fire bars, with a fire-clay cylinder, which need not be very thick, and could be easily renewed when burnt out. This would prevent the heat from fluctuating so much, and prevent the iron from getting red hot, which has a peculiarly disagreeable effect on the air of the room. It would also be convenient to have the fire contained in a cage, made of stout hoop iron or wire; this could be filled with lighted fuel, and dropped into its place, and could be readily withdrawn by a rod and hook, when the fire was out. A stove of this kind will be found very useful and economical in drying and ventilating rooms, but the common error ought to be avoided, of half doing it, or "drawing the damp out of the walls," as it is called.

BLOWING UP OF OLD BAWN BRIDGE, COUNTY DUBLIN.

This inconvenient structure was, for some time past, considered dangerous for public accommodation, owing to the *pooling* of the centre piers—the sheeting of the middle arch on the down-stream side became so injured that half the roadway was rendered unsafe for traffic. In consequence of this the Grand Jury approved of a presentment of £1,000 to remove the old bridge and erect one suitable to the site and sudden rising of the Dodder.

The design of the proposed bridge is by R. J. Hampton, Esq., one of the county surveyors. It will be a graceful structure of one segmental arch 50 feet span, and highly creditable to the engineering reputation of Mr. Hampton.

On Saturday the old bridge was minutely inspected by Messrs. Hampton, Tate, and Frith, the County Surveyors, who decided on rasing the bridge by a simultaneous explosion of four charges, containing each 20lbs. of gunpowder placed in the centre piers. The loading of the mines was given in charge to R. H. Frith, Esq., C.E., who commenced the operation at an early hour on Monday. At one o'clock, Mr. Frith reported the charging and weighting of the mines complete, and immediately after Mr. Robinson, of Grafton-street (who provided the galvanic battery, a Callan's battery of ten cells), completed the placing of the conducting wires to three of the mines—the explosion of the fourth was deemed injudicious, lest the water-way should be blocked up, and cause the river to change its course, which at this period, from the continued rain, was highly probable, as the Dodder had swollen into a torrent, and very much endangered the success of the operation.

The battery was placed on the ground, about twenty-five yards from the bridge, and the wires from the different charges were inserted in cups of mercury. A trigger-break was placed between the mercury cups and the battery, and the arrangements were so made that the battery could be discharged by means of a cord at a considerable distance. The battery was then protected from the effects of the explosion by means of planks.

All being ready, the word "fire" was given, and ere the eye could reach the direction of the low booming sound, the old pile was seen vainly struggling with its invisible and powerful antagonist. The masonry, almost imperceptibly, upheaved, and in an instant the death knell of Old Bawn Bridge was hushed amidst the gurgling sounds of the Dodder.

The details of the explosion were so accurately adjusted that not even a particle was thrown from the piers or sheeting of the bridge, and the battery, at a distance of seventy feet from the mines, was uninjured. The whole operation reflects great credit on the County Engineers, who, under most adverse circumstances, were eminently successful in this the first galvanic experiment that has been applied in the county Dublin for economically removing county works.—*Irish Railway Gazette.*

PROGRESS OF ELECTRIC TELEGRAPH IMPROVEMENTS.

Amid the many practical advantages which are derived from the application of Magnetic Electricity to telegraphic purposes, attention must be drawn to the great importance of the use of the electric clock for scientific observations. Although the beautiful arrangements of Prof. Wheatstone

have excited much attention in this country—and some modifications of his plans been produced—we have not yet applied this means of registering the beat of the foot of Time, in its passage, to any useful end. In the United States, however, the electro-magnetic chronograph of Prof. Locke, having been reported on by Prof. Bache, Superintendent of the Coast Survey, is now adopted by the Government; and the Congress have appropriated ten thousand dollars to Prof. Locke for a clock upon his plan to be erected by him at the National Observatory of Washington. The report of Mr. Walker, Secretary of the Treasury, gives the best description of this clock; and we transfer it to our columns—

"It consists in printing instead of recording the dates of astronomical events on the running fillet of paper of Morse's Telegraph Register. An astronomical clock of the most delicate construction has an apparatus attached to the arbor of the second's hand, so as to make and break the galvanic circuit every second. By putting it in connection with the telegraph line of Morse's at any place on the line, the paper is graduated automatically with the hours, minutes, and seconds. The rate of movement of the clock is not in the slightest degree affected by its action. The paper so graduated is called the *automatic clock register*, and has all the precision for days or months in succession, of the most perfect astronomical clock. Each second consists of a line some nine-tenths of an inch in length imprinted on the fillet of paper, with a blank space for the remainder of the second. The astronomer at any station on a line of several thousand miles in length may imprint on this register the date of any event by simply tapping, after the manner of playing upon a piano, upon a *break circuit key*. This imprints in the indented line a corresponding *break circuit space*. Two or three spaces may be printed in one second, if desired. Two seconds of time is ample for the equatorial interval of the wires of a transit instrument. The network of spider lines is divided into some nine or more tallies, or distinct groups of five wires each. All these tallies in the case of the transit of a star are imprinted on the register in the time occupied by the ordinary method for a single tally, to which a transit has been usually limited. The skill required for tapping on the key at the instant of the bisection of a star is easily acquired, and the accuracy of each imprint is much greater than that of a single record by the common method. The imprints furnish a perpetual record of the date of the event, and may be read off with great rapidity to the hundredth of a second by means of a graduated scale of the paper used for registering. This process has been employed for the first time in the Coast Survey operations; but it will be of great use for the general purposes of practical astronomy.

Lieut. Maury of the United States Navy says, in a communication with which we have been favoured:—"The magnetic telegraph now extends through all the States of the Union, except perhaps Arkansas, Texas, and one other frontier; so that a splendid field is presented for doing the world a service by connecting, for difference of longitude through means of magnetic telegraph and clock, all the principal points of this country with this observatory (Washington). In anticipation of such extension of the wires, I ordered an instrument for the purpose, and it has recently arrived. It is intended to determine *latitude* also,—so that by its means and this clock I hope, during the year, to know pretty accurately the geographical position of Montreal, Boston, Chicago, St. Louis, New Orleans, &c., and their difference of longitude from this place, quite as correctly as the difference between Greenwich and Paris has been established by the usual method and after many years of observation."—*Athenæum.*

ANALYSIS OF BOOKS.

The Marine Steam Engine. Designed chiefly for the use of Naval Officers and Engineers. By Prof. MAIN, and THOMAS BROWN, Ch. E. R. N., pp. 333. London: HEBERT and Co.

THIS is a work of a very peculiar and interesting character—peculiar from the strict limits to which the authors have confined themselves, and interesting, from the novelty of that portion in which the little secrets and mishaps of the Navy engine-rooms are exposed for the edification and warning of engineers in general, and of those gentlemen, who, as the papers periodically inform us, are sent to "Study Steam at Woolwich," in particular.

The authors remark, in the preface, that "the works hitherto published have, while abounding in excellences, been wanting more or less in the kind of information eagerly sought after by those entrusted with the charge of steam-vessels, and which is rarely acquired except through the medium of oral instruction." The reason of this is obvious. Those who are best qualified, are the men who have the least time and opportunity for the task; there is besides an honourable reluctance to expose the accidents arising from the faulty arrangements of the constructors, or from the inadvertence of those who have charge of the machinery. It gives us the greater pleasure, therefore to see a work of so much delicacy undertaken in a right spirit. The authors have carefully abstained from discussions on the respective merits of different engines and their proportions. As they observe, "It can matter but little, practically speaking, to the captain and engineers of a steamer, whether side lever, or direct acting, oscillating or trunk engines are preferable, or whether the paddle or the screw have the advantage as an instrument of propulsion; but it does matter very seriously to them that they should be capable of tracing the imperfect working of an engine to the right cause, and be able to remedy any defect; that they should be skilled in the modes of economizing fuel, on which the efficiency of a steam vessel mainly depends, and that they should by a due knowledge of the skilful management of engines, and of the relation of their parts to each other, be able to diminish the inconvenience of a gale of wind, and be prepared against the accidents of an engagement."

The introductory chapter treats of the general effects of heat and cold. The second contains an analysis of the various parts of the steam engine, all the technical terms being explained with great minuteness. In some few instances perhaps, the language has been adapted to a lower scale of capacity than that with which we trust all the officers of the navy are endowed. The double beat expansion valve may be taken as an illustration of our remark, and we are inclined to think that a sketch would have given a better idea of it, than the most familiar comparisons, even to those not accustomed to inspect drawings. The third chapter is devoted to a description of the various forms of direct action engines. For some of these the authors have done us the honour of quoting the *Artizan.* In this, as in the preceding chapters, but little novelty offers for quotation. Chapter 4, on boilers and their fittings, contain some interesting remarks. We learn that the *Ajax* is fitted with an additional auxiliary engine to maintain a vacuum in the condensers when the engines are standing, and is worked by a separate boiler. The stationary engines, formerly employed on the Blackwall Railway, were fitted in a similar way, to enable them to start with facility. In all large marine engines we should imagine this plan to be very useful. Chapters 5, 6, 7, and 8 on "Getting up the Steam." "Duties to Machinery when under Steam;" "Duties to Machinery during an Action;" "Duties to Engine, &c. on arriving in Harbour;" will be read with great interest, by every practical man.

We shall make a few extracts from those portions most likely to be useful to our readers:—

"On first getting up the steam, and attempting to get a vacuum in the condenser, it is sometimes found that the snifting-valve is drawing air, as it is termed, that is to say, from the valve not fitting tight, air is making its way by these means into the condenser. This is liable to happen from a piece of chip or coal, or a piece of seaweed having passed into the condenser, and becoming jammed under the valve, which allows air to pass in and destroy the vacuum in the condenser. This is usually remedied by a bucket of water being poured on the valve. If this be repeated two or three times it will generally clear it. Sometimes a piece of oakum will get under the valve, which is generally the source of great trouble, for it is apt to wind itself round the spindle, and the water will not be able to wash it away. The consequences of air getting into the engine through the snifting-valve have proved to be more serious than could at first sight be imagined. The snifting-valve not being closed, we shall have a pressure of air against the one face of the foot-valve, and the injection water producing a vacuum in the condenser, that valve will not open on the up stroke of the air-pump, and the water not being pumped off, will rapidly accumulate in the condenser, and at length find its way into the cylinder, and consequently the engine will in all probability be broken down. * * * For the case is by no means exaggerated as the accident actually happened to a steam vessel in Scotland, some time since, from a thread of seaweed getting under the snifting-valve."

"On first getting up the steam in strange boilers, the steam guage should be carefully examined, when the fires are lighted, to see if its float be resting on the mercury. The following device has been adopted at times for the purpose of making the steam pressure seem less than it actually is,

and to make it appear that the engine is doing a great amount of work with weak steam:—A cork or plate with a hole in it, is inserted in the guage-tube, two or three inches above the point where the mercury would stand when at rest, so that the ball of the float rests on this, and never comes in contact with the mercury till the latter has risen above the disc, and as the rod is raised above its proper level, the same amount must be cut away from its length; it will then appear to stand at zero, when the actual pressure is two or three pounds; and whatever be the pressure indicated, the actual pressure will be two or three pounds more. It is necessary, therefore, to attend to this point on first taking charge of a fresh steamer, unless the character of the engineer is known; and especially, if there have been any temptation to do this from the engine belonging to an experimental vessel, or one from which great results have been previously expected and announced."

"When the blow-off cocks set fast, and the brine-pumps do not act, it sometimes happens that the cocks of the boiler hand-pump, or the auxiliary engine can be reversed, and one of these can be used to pump water out of, instead of, into the boiler. This plan was adopted in the *Terrible*, when returning from Portugal lately. The auxiliary engine was employed to extract the brine from the boiler."

"It may be as well here to bring forward an instance to show how easily accidents may happen unless the engineers are on the alert. H. M. S. V. *Comet* was coming over Bilboa bar with a cutter in tow. It was a beautiful day, and quite calm, with scarcely a ripple between the pier heads, but just as she was on the bar, a heavy roller set in, and before the vessel could rise to it (although a good sea-boat) the sea broke on board her. It then came down the hatchway over the cylinders into the engine room, and what with the extra work the paddles had suddenly to contend with, and the condensation of the steam in the cylinders from the application of the cold water outside, the engines completely stopped for an instant; *fortunately, the engineer was at the time between the engines*, and shut off the injection water, otherwise they would have choked up with water, and would not have again recovered themselves. The consequences of losing the moving power at such a time may be easily imagined."

With this extract we must conclude our notice of the Marine Steam Engine for the present.

The Journal of Design, Nos. 1, 2, and 3. London: Chapman and Hall.

It is really quite invigorating to meet with such a decidedly new idea, so successfully carried out, as in this journal. When the *Art Journal* took its flight to the drawing room regions, it left a vacancy for a practical journal, at a price within the means of the mass of designers, which we are glad to see so promptly filled up.

The main feature in the *Journal of Design* is the publication of actual specimens of the fabrics, which can alone give the designer that information and instruction which he requires. No mere engraving, however good, can give a correct idea of the effect of combinations of colour. The specimens of fabrics, and the engravings are very numerous, and we regret that we cannot transfer any of them to our pages. We must let the journal speak for itself as regards its policy.

"In respect of the doctrinal part of our journal, we think that the first step to improve designers is to place within their reach systematic intelligence of what is actually produced. It will be our aim to do this—to present to the designer treatises developing sound principles of ornamental art, and to keep him thoroughly informed of all that is likely to be useful and instructive to him, in his profession. We attach the greatest importance to the art-instruction of all workmen engaged in producing ornamental manufactures. Hitherto this has been altogether neglected. After an existence of ten years, and notwithstanding repeated suggestions, there is but one small elementary drawing-school connected with the Central School of Design. Even now, if any one proposed to teach ornamental drawing in a National School, he would probably be laughed at; yet the boy of the school may, in a few years, become the workman, by whose artistic handiwork, the taste in setting the jewels or gold mounting of a bracelet may be directed. What the art-workman does now, is done by a sort of rule of thumb dexterity, with little knowledge of the principles of the art, and in many cases without the ability of even making tolerably correct outlines. It seems almost incredible, but we were recently told that there were not six working jewellers in London who could put their own work correctly into outline drawing. We may hope, at least, to be useful in amending this. * * * We think the restless demands of the public for constant novelty are alike mischievous to the progress of good ornamental art, as they are to all commercial interests. We think that the School of Design should be reformed and be made business-like realities. We shall wage war with all pirates; and we hope to see the day when it will be thought as disgraceful for one manufacturer to pillage another's patterns, as it is held to be, if he should walk into the counting-house and rob his till. These are some of the points of our political creed, with which we start on our undertaking. In conclusion, we profess that our aim is to foster ornamental art in all way, and to those things for its advance, in all its branches, which it would be the appropriate business of a Board of Design to do, *if such a useful department of Government actually existed.*"

They do, indeed, "manage these things better in France," and we would warn those who have undertaken this task that there is an incredible amount of prejudice to be removed before English Designers will attain their proper rank. If this work be carried on with the same spirit with which it has been commenced, it will deserve the support of every one who has the prosperity of English manufactures at heart.

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION OF THE NEW ROYAL EXCHANGE.

(*Continued from page* 119.)

JOINER.

Internal Fittings to Windows, One Pair.

Royal-Exchange Assurance.—Fit up five windows in court room and committee room, with 1½-inch wainscot splayed and tongued linings, 10 inches wide, with arched head, part semi, part flat, and the linings to have a moulded band, with two stopped ends, mitred ends worked in the same, 7 inches girt; 1¼-inch deal grounds and wainscot moulded architrave, as to doors; 1½-inch one-panel moulded and raised panel window-back, with plain plinth and moulded capping tongued, 3 in. by 1¼; mitred and blocked plinths to architraves, returned to side linings. *N.B.* Put similar plinths to the doors in these rooms.

The finishings inside to windows in two west waiting rooms will be explained in description of the great west window.

Fix to the seven other windows 1¼-inch bead flush window backs, with ¾-inch flush beaded plinth 4 inches wide, and double beaded tongued capping; 1¼-inch deal plain tongued splayed and staff beaded linings to sides and arched heads; 1½-inch framed grounds 4½ inches wide, and architrave 10 inches girt.

The windows in strong room will be similar to the last, and of similar size, and finished in the same manner as window in the room below.

The great window in west waiting rooms will have cast iron ornamental guard. Fix inside oak frame and sill 5 in. by 4, with two muntins 5 in. by 4, and 2½-inch wainscot moulded sashes glazed with sheet glass. The two middle sashes, hung with three pair of 3-inch brass butts, and fix espagnolette bolt on meeting styles, tongue and groove to hanging styles; double rebate and bead to meeting rail, rebate and throat to bottom rail; brass moulded stop on sill to middlesashes only; copper tongue under to oak sill; 1½-inch plain deal keyed window-back, 1 foot 6 high; double beaded capping. Fix all round 1¼-inch staff bead tongued on oak frame.

London-Assurance Offices.—Fit up four windows, three having semi heads, as court room of the Royal Exchange Assurance offices.

Fit up staircase window with 1¼-inch deal tongued, splayed, staff beaded, and grooved linings all round. Fit up window in small room with similar linings, and 1¼-inch plain deal keyed back (cut bead), and double reeded narrow capping.

Fit up ten other windows, as the seven windows in the offices of the Royal-Exchange Assurance.

Unappropriated Offices.—Fit up six windows, as the seven windows of the Royal-Exchange Assurance offices. Fit up one window in lobby, as small room in London-Assurance offices. The inside fittings of one window are described with joiner's work connected with water-closets.

Lloyd's Rooms.—Fit up the great window of staircase with a deal cased frame, with wainscot edges and other wainscot parts, as before described,

and $2\frac{1}{2}$-inch wainscot sashes, double hung, with catgut lines, lead weights &c., complete, and glazed with polished sheet glass; three small brackets, each of 10s. value; copper tongue to sill. Fit up inside with $1\frac{1}{4}$-inch wainscot plain keyed pilasters, and narrow returns, with moulded and mitred caps and bases, the whole mitred, glued, and blocked. Fix proper deal grounds for all the wainscot fittings; $1\frac{1}{4}$-inch sunk wainscot frieze, with mitred ends; wainscot moulded impost, 27-inches girt, with 4 mitres and returns. Wainscot archivolt, 16-in. girt on circular deal grounds, 12-in. wide; narrow wainscot soffit 3 inches wide to archivolt, to be mitred, glued, and blocked to it; $1\frac{1}{4}$-inch wainscot plain keyed window-backs, with $1\frac{1}{4}$-inch wainscot rebated plinth, 8 inches wide, base moulding 4 inches girt, surbase moulding 7 inches girt, and $\frac{1}{2}$-inch wainscot tongued capping, $3\frac{1}{2}$ inches wide. All to be housed into pilasters, and plinths tongued and mitred to plinths of pilasters.

Fix to four windows on the north side of the commercial room, inch deal one side glued and blocked boarding for painting to cover the blank windows. To fix to the five windows opposite $1\frac{1}{4}$-inch wainscot splayed and tongued linings continued round circular heads, and also all round wainscot beaded and double rebated ground 3 inches by $1\frac{1}{2}$. Fit up window in closet, west end of this room, with $1\frac{1}{2}$-inch deal plain keyed window back, with double beaded and tongued capping and linings, as to the other windows, but to be deal, and not wainscot.

Fit up the three windows in lobby with $1\frac{1}{4}$-inch wainscot rebated plinth 9 inches high, and moulding 6 inches girt; $1\frac{1}{4}$-inch wainscot plain framed grounds, the heads cut circular; $1\frac{1}{4}$-inch wainscot tongued and keyed linings all round, and double beaded and rebated wainscot ground 3 inches by $1\frac{1}{2}$; the remaining dressings will be plaster.

Fit up the five windows in the captains' room with wainscot fittings similar to those described for the Royal-Exchange Assurance.

Fit up the window east side of secretary's room with $1\frac{1}{2}$-inch wainscot moulded and raised-panel window back, with moulded capping, 3 by $1\frac{1}{4}$, of wainscot, tongued on, and $1\frac{1}{2}$-inch wainscot tongued, keyed, and splayed linings, with moulding 7 inches girt worked thereon, with stopped end, and to be continued round circular head; also wainscot moulded architrave all round, 12 inches girt. Proper deal grounds and backings for the whole.

Fix to the small window opposite deal cased frame with wainscot edges and fittings, and $2\frac{1}{4}$-inch wainscot sashes, with catgut lines and lead weights, double hung, brass axle pulleys, and the sashes to be glazed with polished sheet glass. Copper tongue to sill, and patent sash fastening; the sash fastenings to this and all other windows to be of the value of 3s. each, exclusive of profit and fixing.

Fix inside to this window, window-back, capping, linings, with moulding worked thereon and stopped, and architrave; and all other fittings, in deal and wainscot, to be like those described for the opposite window.

Fix inside the east window in tower, $1\frac{1}{4}$-inch deal bead flush window back, with double beaded and tongued capping and semi linings, each side 4 feet high, the remainder of sides and soffit will be plastered; with proper bracketting fixed for it. Moulded architraves 12 inches, with plinths and proper grounds; the circular head plaster. Fix to the east window in clerks' room, $1\frac{1}{4}$-inch keyed tongued and splayed linings of deal, continued round semi head with grounds, architrave also round semi head, 10 inches girt. Plinths to architrave. Fit up the window in bar with deal fittings, similar to those described for the offices of the Royal-Exchange Assurance.

Fix in window opening on the staircase to second floor, frame, sashes, glass, and ironmongery, the same as described for west window of the secretary's room; and fix inside $1\frac{1}{4}$-inch deal tongued staff beaded and splayed linings, all round, including bottom and arched head.

Fix to the two windows in reading room, ledged covers for paint, as described for the other blank windows; the heads cut.

Unappropriated Offices.—Two windows, one in board room, a semi 10 feet diameter net, and the other 4 feet 6 by 6 feet net, which are shown on plan No. V. of the second story. Fix in both of them oak proper frames and sill 6 inches by 4 with copper tongues, and $2\frac{1}{4}$-inch wainscot sashes, glazed with polished sheet glass; the frames grooved for plaster.

Windows and Sashes, Second Story.

Royal-Exchange Assurance: Under Skylight.—Fix in ceiling round five openings $1\frac{1}{4}$-inch staff beaded linings 9 inches wide, and moulding 5 inches girt; and fix deal fittings inside, under great sloping skylight over area, cistern room, water-closet, and small staircase, of the value of 5*l*. Fix to the three windows deal cased frames, 2-inch ovolo sashes, double hung, patent lines, brass axle pulleys, iron weights, patent brass sash fastenings; two windows to have sills 8 inches wide, throated, and fix outside on each of these two windows fittings 12*s*. in value. Fix inside $1\frac{1}{2}$-inch tongued and rounded window boards, narrow grounds and single architraves, and to one of them inch plain tongued linings.

London-Assurance—Fix to three windows frames, sashes, and fittings as the last; one window a triple frame, muntins $1\frac{1}{2}$ wide. To fix to openings ceiling of passage 2-inch ovolo flat sashes, hung with $3\frac{1}{2}$-inch wrought butts (three to one sash) to $1\frac{1}{2}$-inch rebated and staff beaded linings 7 inches wide, and to one fix two 6-inch brass sockets and barrel bolts, and to the other three similar bolts. Fix to the other openings in ceiling floor under skylight, linings and moulding as described before.

Unappropriated Offices.—Two windows; to be the same as windows in curbs of Royal Exchange Assurance.

Lloyd's Rooms. See drawings XVIII. and XIX.—Fix to circular window in tower cast iron sash, and allow 21*s*. for casement. Fix to the other two windows cased frames, and $2\frac{1}{4}$-inch wainscot sashes, sash fastening, fix inside $1\frac{1}{4}$-inch plain tongued staff-beaded linings all round.

Commercial Room.—Five horizontal lights to be formed in ceiling floor. Fix fir frame 6 inches by 6, moulded, rebated, and grooved; $2\frac{1}{2}$-inch deal fancy moulded flat sashes, glazed with ground sheet glass.

Windows, Ground Story, and Mezzanine Story.

Royal-Exchange Assurance.—Fit up Venetian window west front, which lights both stories, as follows:—Oak moulded frame; jambs and muntins 5 inches by 7 deep; the transom 9 inches by 6; the head 7 inches deep, with 2 inches added for carving. Oak frame for semi fan to correspond 7 inches by 5, and oak carved centre out of 9 inches by 5; oak sill for frame and fan 7 inches by 5, with copper tongue in oak, and stone sill and transom; execute sundry mouldings and carvings to these two windows, as will be ordered by the architect, to the extent in value of £50. The eight divisions of frames to be rebated for, and have fixed in, eight pieces of $2\frac{1}{2}$-inch wainscot moulded sash, prepared for twenty-two sheets of polished plate glass; sixteen of them 51 inches by 21, four of them 51 inches by 16, two of them 70 inches by 16. The bottom of oak sill 6 feet 4 above ground floor; the bottom of sill of fanlight 8 inches above one-pair floor. Allow 5 feet cube fir for trimming, and fix $1\frac{1}{4}$-inch sunk and staff beaded apron, moulded nosing, $1\frac{1}{4}$-inch bar balusters, and wainscot moulded handrail 3 inches by 2, with rounded ends in the mezzanine floor, with circular corners; 2-inch deal, two sides, framed and moulded skeleton window back, rebated and filled in with 2-inch wainscot casements, the centre pair folding, hung with $3\frac{1}{2}$-inch brass butts; two 9-inch brass flush bolts, and a casement mortice latch; the casements to be glazed with polished plate glass, four squares $26\frac{1}{2}$ inches by 45, four ditto $26\frac{1}{2}$ inches by 14; and allow £10 for sundry fittings, beyond what are shown and described, connected therewith. Four 2-inch framed and moulded pilasters 1 foot 8 inches wide, 15 feet high, with moulded and mitred caps, 12 inches girt, and moulded plinths 12 inches high, mitred round, glued in rebates, and to be continued along window backs; grounds on wall for these pilasters; moulded surbase 8 inches girt on window back below these pilasters. Take all rebates and grounds needful.

Four similar pilasters in mezzanine story, 9 feet 1 inch high, and to be $1\frac{1}{2}$-inch deal only. No window-back on this story. Fix inside on the one pair stairs windows $1\frac{1}{4}$-inch plain keyed window-back 10 inches wide, 8 feet 6 long, with mitred narrow capping tongued, $2\frac{1}{2}$ inches by 1; two block plinths 13 inches by 10. Semi moulded architrave 12 inches girt, and narrow grounds for pilaster.

Allow £15 for outside shutters to ground floor windows.

Fix two small windows west end, one to be 9 feet by 2 feet 10, the other 9 feet by 1 foot 6 net; frames and sashes as to the one-pair windows, glazed with plate glass, four sheets 14 inches by 25, four sheets 30 inches by 25.

Fix inside 1½-inch deal window board, with moulded nosing and hollow; 1½-inch two-panel bead flush and square shutter and back flaps, shutters in one height; three pair of 3-inch butts; three pair back flaps; brass shutter latches and knobs; shutter bars; 1½-inch one-panel bead flush and splayed soffit; 1¼-inch bead flush back linings; 1½-inch boxing and moulded architrave 9 inches girt; narrow grounds for plaster, but no return linings. Fit up window in strong room with iron sash glazed with sheet glass.

East Area.—Fit up two windows to staircases each side of tower, ground story, as follows:—Semi head 4 feet wide, whole height 8 feet 6; deal cased frames, oak sunk sills, 1¼-inch wainscot pulley-stiles only, and 2¼-inch wainscot moulded sashes glazed with sheet glass, double hung, patent lines, iron weights, sash fastenings, inside boxing shutters in six folds as high as springing; 1½-inch bead flush and square shutters and back flaps framed, two panels hung in one height; three pair 3-inch butts, six pair back flaps, shutter bars, brass shutter latches and knobs; 1½-inch window board with bead on edge flush with stucco; 1¼-inch bead flush linings; 1½-inch boxing with flush bead on outer edge; 1¼-inch soffit to boxing of shutter, rebated for stucco soffit; bracket out for splayed stucco soffit.

Banking-house and Unappropriated Offices over.—The great west window to be like the corresponding one, including every article and provision for extra work, except as follows:—that the finishings inside on one-pair story will be wainscot, and the glass plate glass; and the window-back on the ground story will be 7 feet 6 high, and the pilasters 16 feet high.

The two small windows, ground story, will be like the others opposite. The two small windows which light staircase from the ground to mezzanine story to have deal cased frames, oak sunk sills, wainscot edges, pulley-pieces, and beads; 2¼-inch wainscot moulded sashes double hung with catgut lines, brass axle pulleys and lead weights; copper tongue to oak sill; two sash fastenings; to be glazed with plate glass, two squares to one window 14 in. by 21, and two to another 19 in. by 23. Fix inside 1½-in. deal-tongued, splayed, and staff-beaded linings, and 1½-inch deal tongued and rounded window boards and bearers, with moulded nosing. These and all other window boards throughout to have mitred returns and to be cut to fit splayed jambs of windows.

Fix to the eight windows in the mezzanine story deal cased frames with flat arched heads, oak sunk sills, wainscot pulley styles only, and 2¼-in. wainscot moulded sashes glazed with sheet glass; the sashes double hung, patent lines, iron weights, brass axle pulleys, and patent sash fastenings. Fix inside 1½-inch two-panel bead flush window back to all but one window which lights staircase, which is to have 1½-inch splayed, tongued, and staff beaded linings to bottom and two sides, and the soffit to be plastered.

Narrow tongued capping to window backs, 1½-inch tongued and staff beaded linings to sides, and also to flat arched soffits of the seven windows.

Windows, Basement Story.

Fix to the eight windows, six to basements of shops in east area, and two to shops on the south side, deal cased frames, oak sunk sills, 2-inch deal ovolo sashes, double hung with patent lines and iron weights, glazed with second glass; fix a sash fastening to each; two of the windows 4 feet by 4 net, two of them 2 feet 10 by 4 feet net; and two of them 1 foot 6 by 4 feet net; the other two 4 feet 8 by 4 feet 8 net.

Fix to these windows 1½-inch tongued and rounded window boards, and 1½-inch tongued and rounded linings.

Fix in window of water closets of the Banking-house, in the north-west angle, similar frame and sashes, glass and ironmongery complete, but to be a triple frame 7 feet by 4 feet 8; and fix inside 1½-inch tongued, splayed and beaded linings.

Skylights, &c.

Two-and-a-half inch one side dovetailed curbs to skylights, 10 inches wide, and metal skylights secured down, and glazed with sheet glass in squares, 12 inches wide, and two laps in each. This description applies to all the sloping skylights shown in plan of roofs, No. VI., excepting great west roof.

Fix to roof of reading room in Lloyd's rooms, circular lantern as follows, and as is shown in drawings No. XVIII. and XIX.; oak sill 9 inches by 5 bolted at joints, wrought, sunk, rebated, and grooved; oak muntins 7 inches by 4, double rebated and beaded, and extra carved, for which allow £6 10s. for the labour of carving; oak rebated and beaded head 7 inches by 2½; circular for head above 7 inches by 6. Frame conical roof over with rafters 6 inches by 2½, framed to plate, and an oak ridge block, 12 inches by 12 by 8; one turned oak terminal framed in, out of 15 inches by 5 by 5; eight cross ties to rafters 6 inches by 3; 1¼-inch deal lining wrought to circular head, and inch soffit to eaves, circular two edges; the roof to be boarded with ¾-inch deal bent, and fix tilting fillet, and rolls for lead; ¾-inch rough jointed to sides below sill, and complete the spandrils of flat with 1¼-inch boarding and timber needful. Fill in sides with eight metal lights, 3 feet 6 inches by 8 feet glazed, of the prime cost value of £96 including a ventilator in each.

To fix in opening in lead flat, east end of upper roof of the London Assurance offices, to the octagonal opening in lead flat of the Royal-Exchange Assurance offices, and to the elliptical opening in lead flat over the entrance to the unappropriated offices in one-pair story, 2-inch copper moulded skylights, glazed with sheet glass, and fix to each a large ventilating cap, with brass frame, chains, and balance weight complete.

Fix in the spandril of the ceiling of Lloyd's room, twelve frames with elliptical heads, 6 inches by 4, wrought, rebated, and grooved, and moulding worked on edge, three inches girt; fix on them 2-inch moulded copper sashes of elliptical shape and ornamental pattern, glazed with ground sheet glass; fix to these and other sashes 20 ventilators of the value of £35 15s.

Provide and fix a skylight, as will be directed by the architect, in the flat over staircase to the unappropriated offices, including all works in each trade, to the extent in value of £15 above and more than the saving to be made by omission of lead flat. The contractor to provide for two skylights and flats over part of shops south side of east area, including all trades, to the extent in value of £50 pounds for the two.

Generally all directions and descriptions of workmanship connected with joiners, hereinbefore given, to apply, as far as they are applicable, to the joiner's work of the windows and their fittings. The bottom beads and bottom rails of sashes, and also the meeting rails, to be splayed, that they may shut close, and open easily; all joints to circular heads of frames to be bolted, and all bolt heads covered.

The contractor to execute extra works connected with windows and skylights, beyond all other works shown, described, or provided, which the architect shall direct, to the extent of £300 in value.

Staircases.

Fix, to enclose the staircases leading to basement story, as follows:—

London Assurance.—Two-inch bead flush and square spandril and door, with circular corner; the door to be a sash door, glazed with second glass, hung with 4-inch butt hinges, and fix to it a good mortice lock; rebate and angle bead to framing, rebate and beaded stop to door, and iron stubs top and bottom to fix spandril into stone.

Royal-Exchange Assurance.—Fix spandril partition, door, ironmongery and glass, as the last.

Banking-house, North-west Angle.—Fix spandril partition, door, ironmongery, and glass, as the last.

Unappropriated Offices, North side.—Fix spandril partition, door, ironmongery, and glass, as the last.

Lloyd's.—Fix spandril partition, door, ironmongery, and glass, as the last, but wainscot instead of deal.

Prepare and fix wood staircases, as follows:—

Royal-Exchange Assurance, South Side.—One-and-quarter best deal steps, inch risers tongued, moulded nosing, the whole housed to 1½-inch rebated wall strings; and to be cut, return moulded, and mitred, to 2-inch cut, sunk, mitred, and staff beaded wall string. The whole to be glued,

blocked, and bracketted for plastering, and landings to match with framed bearers. Wainscot handrail 3 by $2\frac{1}{4}$; 1-inch bar balusters dovetailed; wrought iron newel and bolt and balusters and straps; narrow ground and torus moulding to string; moulded nosing, $1\frac{1}{2}$-inch apron lining to match, with handrail and balusters also to match.

To fix, to ascend to the upper rooms of Lloyd's, a similar staircase in every respect, but varied in plan, for which see drawings.

The small staircase in the Royal-Exchange Assurance to be plain $1\frac{1}{2}$-inch, with rounded nosing, and plain $1\frac{1}{2}$-inch wall string; the steps housed to it and to a continued newel.

Fix a similar staircase to ascend to porter's room in the Unappropriated Offices.

The contractor to provide and fix the following handrails, for the stone and iron staircases, to be made of fine selected *Riga* wainscot:—Forty-six feet run moulded handrail, 3 inches by $2\frac{1}{4}$, grooved for iron rail; 4 feet run do. circular; 40 feet run do. wreathed; four pieces of wreathed and twisted do. of the prime cost value of 10s. each; four mitred caps; one large ditto; four extra to ramps in caps;—170 feet run moulded handrail 4 by $2\frac{1}{2}$, grooved for iron rail; 24 feet run do. ramped; 18 feet run do. circular; 123 feet run do. wreathed; one mitred cap; three pieces of wreathed and twisted to semi, of the prime cost value of 15s. each; one do. do. to curtail; 106 handrail screws; 14 ends of handrail let into wall:—65 feet 10 inches run moulded handrail 6 inches by 4, in three thicknesses, glued, screwed, and grooved for iron rail; 3 feet 6 run do. circular; 31 feet run do. wreathed; one piece of ramped do., with large mitred cap; forty-six strong handrail screws. Provide for extra work to Lloyd's staircase, to the extent in value of £50. Provide for the thirty-four cylindrical iron staircases as follows: 527 feet superficial 1-inch deal staff beaded apron; 263 feet 6 run rounded nosing $2\frac{1}{2}$ by $1\frac{1}{4}$; 263 feet 6 do. do. $2\frac{1}{2}$ by $1\frac{1}{2}$; two hundred and four mitres to do.; 3672 feet run 1-inch deal dovetail balusters; 263 feet 6 run wainscot moulded handrail 2 by $1\frac{1}{8}$; 952 feet run do. do. to the wreathed outer string, grooved and fitted to iron rail, fixed with screws; two hundred and four newel caps, cut and mitred out of the solid; three hundred joints, screwed or otherwise strongly secured.

Provide for cutting for iron staircases £34.

The contractor to fix in Lloyd's rooms some pillars of such form and materials as the Architect shall direct, and of the value of £270.

All the prices and values given in this part of the Specification to be the prime cost value of labour and materials, whether so written or not.

The contractor to execute sundry extra fittings which the architect shall order, to the extent in value of £1600; and this sum is to include the contractor's profit, which he is to have upon extra works, according to the conditions of the contract.

All the works for which provision is made in quantity, price, and sums of money, are to be examined, measured, and valued, and the excess or deficiency in quantity or value, so be estimated according to the conditions of the contract, and allowed for accordingly.

NOVELTIES.

Sale of Engines on the Blackwall Railway.—On the 9th instant, Messrs. Pullen and Son sold, at the Auction Mart, the stationary engines which were employed to work the rope, and which have been dispensed with since the extension of the line to the Eastern Counties, and the adoption, in consequence, of locomotive power. The first lot consisted of a pair of side lever engines, of 220 horse power, cylinders 56 ins. diameter, and 5 feet stroke, by Messrs. Maudslay and Field, £3,350. Lot 2, a similar pair, £3,300. The two pairs of engines at the Blackwall end, constructed by Mr. John Barnes, of 150 horse power, cylinders $45\frac{1}{2}$ inches diameter × 4 feet stroke, fetched £2,200 and £2,250 respectively. The boilers and fittings averaged £55 to £65 each.

The Railway Provident Mutual and Benevolent Association.—Insurance offices are not supported by the middle and lower classes as they should be: their value is not sufficiently appreciated. The sick funds and other societies amongst the working classes are not, we fear, conducted on such sound and healthy principles as to render this point an unimportant one. In the case of the above Association, we have no doubt that the directors trust, in some measure, to the *esprit de corps*, which supports so many similar institutions. The railway system offers peculiar facilities for carrying on a centralised and economical arrangement. As prospectus may be obtained on application to the secretary, we need not go into the details of this particular case. As an inducement to every working man to assure, it will surely be enough to mention that a sum of $7\frac{3}{4}$d. paid monthly by a member, aged 25, will secure his family £20 at his death.

Meteorological Phenomena.—On the evening of 3rd inst. a most extraordinary phenomena occured here. The morning had been very sultry, and the sky clear and brillant, until about six o'clock, p.m., when clouds of a peculiarly dark green colour began to form in the East, spreading rapidly over the whole horizon. A strong wind then arose from the East, driving before it clouds of very fine dust, so dense that objects within a very short distance could not be perceived. The face of nature assumed a strange greenish hue, and the river looked extremely black and was much agitated. Sulphurous vapours were, at same time, quite palpable to the senses. The change from strong sunlight to almost mid-night darkness was so sudden and strikingly impressive that many persons were seriously alarmed. After about half an hour a heavy shower of rain fell, and again cleared the atmosphere.—*Clonmel Chronicle.*

Manufacturing Industry *v.* Mineral Treasures.—Ever since the middle ages, when permission was given to commoners to amass fortunes by honest and persevering enterprise, the members of the industrial world have, from generation to generation, gradually enriched themselves by the acquisition of land, workshops, warehouses, &c. To form a just idea of this source of opulence in the industrial community, like that of the French, Dutch, English, and Anglo-Americans, compare it with the source of the most fabulous treasures—with those treasures poured during three centuries by Mexico and Peru at the feet of conquerors who had little sympathy with industry. At the end of three centuries scarcely a trace of these rivers of gold is left upon Spanish ground. And what is the result? Whilst the four eminently industrious nations, by the simple manufacture of their wools, silks, and foreign cotton, by the working of their iron and mineral coal, by their fisheries, and the produce of their soil, have enriched the community, Spain has sunk into the depth of poverty—a fitting reward for its idleness.—*Report of the (Paris) Society for the Encouragement of National Industry*, 1848.

Submarine Telegraphs.—The Court of Common Council have granted permission to Messrs. Blunt to lay down the electric telegraph across the Thames, to communicate with the coast line, Messrs. Blunt agreeing to remove any work that may be found objectionable at their own cost.

Electric Telegraph—South-Eastern Railway.—C. V. Walker, Esq. the superintendent of the Electric Telegraph on the South-Eastern Railway, furnishes, in a communication to the daily papers, some interesting details as to the damage done to the telegraph in a recent snow-storm. He states that: —"All was well until six p.m., and probably later. Frost now attended the snow, and it began to congeal with the rain about the telegraph wires. This process continued until the wires along their whole length were each enclosed in a coating of snow about the thickness of a man's arm; this accumulated weight required little aid from the wind (which indeed blew a gale) to bear down the poles. Before midnight some 60 or more poles, either singly or in sets of 2, 3, and in some cases of 4 and 5, were broken short off at the ground, and as many more were overthrown." "I visited (says Mr. Walker) the various scenes of the accidents the following morning, and from the examination I was enabled to make of the snow cylinders, I believe that each yard of wire was surrounded by not less than 10lb. or 12lb. of congealed snow. Each pole had to sustain a weight of from 2,000lb. to 3,000lb., and in some cases double this. In places where poles withstood the pressure, the wires were so extended by the weight as nearly to touch the ground; and on the snow leaving them they nearly recovered their original position—an interesting proof this of the value of iron wire. In the cases were lengths of copper wire were exposed, they have not recovered their original position."

At Adelaide, South Australia, a project for the disposal of town and country lots by lottery, on the principle adopted by the Bank of Australia at Sydney, to the amount of 25,000*l.* in 5*l.* shares, has been started, and was expected to meet with immediate success. The first 1000 sheep of the present year had been boiled down at the establishment at Adelaide, and the result was a net produce of $26\frac{1}{4}$ lbs. of tallow per sheep. Mutton hams had been cured for exportation. At Port Lincoln, a quarry of pure white marble had been discovered, as also copal, and the singular mineral, asbestos. At Portland plumbago is said to have been discovered also.

The Grimsby Docks.—His Royal Highness Prince Albert (on the 18th April) having laid the foundation stone of the stupendous docks about being formed at that port, the following particulars, in reference to that important undertaking, will be read with interest at the present moment:—In 1845, a company was formed for the purpose of making a dock at Great Grimsby, worthy of its admirable local position, and to connect it by the then contemplated railway with all the principal towns of England. Grimsby lies on the north-eastern coast of Lincolnshire, at the widest part of the mouth of the Humber, facing the sea, and protected by a curve on the Yorkshire side of the river, known as Spurn Point, from all the storms of the German Ocean. The company, having obtained their Act of Incorporation, purchased all the property of an old dock, which had for some time fallen almost into disuse. The promoters of a succession of railways, since amalgamated under the title of the Manchester, Sheffield, and Lincolnshire Railway, made Great Grimsby one of its termini. The company, seeing the importance of executing the works of the docks upon a scale which would render them a first-rate shipping station, proposed to purchase the Dock Company, and it was accordingly amalgamated with the Manchester, Sheffield, and Lincolnshire Railway. The works were then placed in the hands of Mr. Rendel, the engineer of the Birkenhead Docks, and he was ordered to construct the warehouses on the most complete scale, as a branch, a feeder, and a water station to the railway. The dock works consist of a wet dock on an area of about 35 acres, walled in on the left side by a wharf, 2,000 feet long, 200 feet wide, and 36 feet high, having at the extremity a pier of great length—making a waterside quay and pier nearly a mile long. This will be the passenger pier for steamers from Hamburg and the Baltic. The eastside wharfing, which is of the same length and 670 feet wide, will be partly covered with warehouses. The passage to the docks will be through an entrance basin formed by the two piers (area about 20 acres), within which, and alongside the piers, vessels not required to enter the docks will lie. Thus a steamer may discharge passengers and goods into railway carriages and trucks brought right alongside, and, taking mails and Manchester silk and cotton goods aboard from other trucks, go to sea again all in one tide. The communication between the open tidal basin and the two docks will be effected by two locks. The one, 300 feet long and 65 feet wide, will admit the largest war steamer at any time, except an hour before and an hour after dead low water. The other will be 200 feet long, and 45 feet wide. At the lowest tide there will be six feet of water on the threshhold of the dock gates. All the ordinary class vessels and steamers will find water enough to enter and lie in the basin at any hour. The dock has capacity for accommodating 700 average ships, and the basin 500—in all, 1,200. These docks,saving 20 miles of river navigation, and lying 50 miles nearer London tha Hull, will always enable passengers and mails to reach the metropolis six hours sooner than by way of Hull.

Floating Breakwaters.—"By a good French chart, which I had copied on board the *Dido*, and with the pilotage of the old native, we found our way about sunset into the anchorage of Waitangai, avoiding in the dusk, a bank of kelp, which afterwards proved to be the safeguard of our vessel, for the sea runs so high in this exposed roadstead, and the eddies of wind come off the land with such fury, that nothing but this floating breakwater of sea-weed preserves vessels from being driven ashore. *(From the Bishop of New Zealand's Journal.)*—This remark offers an interesting coincidence with a similar fact noticed in our review of Mr. Smith's plan for a breakwater in a previous number.

Reduction of Duties on Metals in Spain.—The duties, which have for a very long period existed in Spain on the importation of foreign metals and machinery, and which from their heavy amount have almost acted as a prohibition, have been thoroughly revised, and the new tariff is expected to be immediately issued by the Government. It is generally believed that such a reduction will be made as will greatly increase the commercial intercourse between this country and Spain. The difficulty of obtaining machinery, except at exorbitant prices, has tended greatly to obstruct the developement of the mineral wealth of the country; but the Government, by this reduction of duties, will evince a wise desire for the interest of mining adventure and railway enterprise. The movement has already induced some wealthy French and Spanish capitalists to undertake the completion of the railway from Barcelona by Valencia to Madrid, which will create a large demand for rails, locomotives, and machinery. This reduction of duties on foreign produce will tend greatly to the increase of wealth and happiness in the country, and most probably place her, in a commercial view, in a highly respectable position among European nations.

Method of Soldering Cast-Iron with Wrought Iron.—The following process has been recommended for this purpose:—First, melt filings of soft cast-iron with calcined borax in a crucible; then pulverize the black vitreous substance which is thereby produced, and sprinkle it over the parts which are intended to be united; after which, heat the pieces of cast and wrought-iron and weld them together on an anvil, using only gentle blows. This method is peculiarly applicable for the manufacture of iron articles which are intended to be made red hot, and are required to be impervious to fluids or liquids, as such a result cannot be obtained.—*Sheffield Times.*

Railway Statistics.—A return ordered by Mr. Labouchere, M.P., supplies the following data respecting the number and description of persons employed on railways throughout the United Kingdom. It appears that the grand total number of persons employed on 4,252 miles of railway, open for traffic in May, 1848, amounted to 52,688, viz.:—81 secretaries, 30 managers, 29 treasurers, 95 engineers, 343 superintendents, 125 storekeepers, 70 accountants, 48 cashiers, 106 draughtsmen, 4,360 clerks, 1,011 foremen, 1,752 engine drivers, 1,809 firemen, 1,464 conductors or guards, 10,814 artificers, 1,058 switchmen, 2,475 policemen, 7,632 porters, 197 messengers, 4,391 platelayer 14,297 labourers, 401 gatekeepers, 141 waggoners, 32 breaksmen, and 97 miscellaneous. The grand total number of persons employed on all railroads in the course of construction, on the 1st day of May, 1848, amounted 188,177.

Boats of Gutta Percha.—Considerable interest has been excited at Newcastle by a race between an ordinary wooden boat and one constructed of gutta percha. Gutta percha beat by several lengths to the great confusion of the shipwrights.

Portsmouth.—A Bee's Nest Enclosed in an Elm Tree.—The sawyers of the dockyard, Portsmouth, in slitting down an elm tree of large magnitude, found in a cavity in the heart of the tree a most perfect bees' nest, with four divisions of comb, in length about 14 inches, with the bees in their cells, and otherwise, particularly the queen bee, in the most perfect condition; above and below the nest the heart of the stick was perfectly sound, as was also the timber surrounding the nest; no hole was discoverable in any part, the timber being perfectly solid all round. There were also in the cavity a few small snail shells; no doubt the tree many years back, from its quick growth in the spring of the year, closed over the small hole, by which the bees went out and in, and imprisioned those that were in the nest. It was a beautiful specimen of the bees' nest, but unfortunately the sawyers pulled it to pieces without knowing that they were destroying a curiosity.

A Useful Invention.—An invention has been brought out at the Rugby Railway Station ~~during the last week~~, by Messrs. Crawford and Grew, both officials of the North Western line. The object of the invention is to supersede the present barbarous practice of coupling and uncoupling railway carriages, which is effected by running or dashing a loose carriage with great violence against the train, in order to compress the buffers, and bring the carriages nearer together, one of the porters being stationed the whole of the time between them, ready to lift the connecting link from the hook fixed to the carriage—and who, by the way, sometimes leaves a finger behind him by the same process—the moment the shock is given. If one carriage should prove insufficient, two or three are used, and frequently the engine itself has to be employed before sufficient force can be imparted to the centre of the train, jolting the passengers from their seats, and upsetting or otherwise injuring any horses that may perchance be conveyed by the same train, reminding one of the "battering rams" employed by the ancients in their warlike operations. The "cramp," which is to render all this unnecessary, consists of nothing more than two links or hooks, connected by what is termed a right and left-handed screw, the peculiarity of which is that by turning it in one direction the links are drawn close together, and by turning it in the other, the links are extended. The "cramp" when being used, is hooked to the side chains of the carriages, and by its action the buffers are compressed, the carriages drawn nearer together, and the connecting link removed or attached with remarkable ease and considerable saving of time. The "cramp" is now in use at the Rugby station, and it is to be hoped the directors will appreciate the services of Messrs. Crawford and Grew by bringing into general use an invention which, though simple in itself, will add so much to the convenience and comfort of their passengers.—*Architect.*

Improvements in Billingsgate Market.—In consequence of the vast increase of business transacted at Billingsgate Market, it has become necessary to enlarge the area of the market for the better accommodation of the salesmen and the public, and the convenience of the fish trade generally. For this purpose it is intended to add to the area of the market the space occupied by Billingsgate Dock, by enclosing it with a wharf wall, in continuation of the line of Custom-house-quay, and extending to Joiner's-quay; also removing the portion of the market now projecting into the river beyond that line. The whole of the present roofing and arrangement of the market to be removed entirely, and a new roof to be constructed with skylights facing the north, and a handsome façade 180 feet erected next to the river, with a lofty clock and bell tower in the centre, in harmony with the new Coal Exchange. Fronting Thames-street a warehouse is to built for the reception of fish brought into London by railway; and on the site of the dock a submarket is to be constructed for sale of shell fish. The whole of the alterations are from a design furnished by Mr. Bunning, the City's architect, at an estimated cost of about 20,000*l.*

THE ARTIZAN.

No. IX.—Fourth Series—SEPTEMBER 1st, 1849.

MECHANICAL ENGINEERING.

CONSTRUCTION OF THE BRITANNIA AND CONWAY TUBULAR BRIDGES.

By W. Fairbairn.

(Continued from page 189).

"At this time, July 19—21, a considerable number of experiments had been made—nearly the whole of the cylindrical tubes had been tested, and preparations were then in progress for the rectangular and elliptical forms. The difficulties experienced in retaining the cylindrical tubes in shape when submitted to severe strains, naturally suggested the rectangular form; many new models of this kind were prepared and experimented upon before the end of July; and others, with different thicknesses of the top and bottom plates or flanches, before the 6th of August. This is clearly indicated by the date of the experiments, and the letter of August 6, addressed as before to Mr. Stephenson. This letter, it will be observed, strongly enforces the striking and unmistakeable evidence, afforded by the experiments, of the necessity of a close adherence to the principle of the simple beam or girder. Up to this period my object had been to test the principle, originally suggested by Mr. Stephenson, of a structure, every part of which, although rigid, should be brought into a state of tension, and whose strength should consist, not as that of a beam or girder does, in its resistance to extension on the one side and to compression on the other, but in a resistance to extension on both sides. For the adoption of such a form, if it could have been found, there was this plausible argument—that the tenacity of wrought iron being much greater than its resistance to compression, there would obviously have been an economy of the material in so shaping the tube as to call into action its tenacity only. All my attempts to find such a shape as this were, however, fruitless. Every experiment gave the most certain evidence of a compression on the one side of the tube and extension on the other, and it yielded alike when the one resistance or the other was overcome. From this time the question presented itself, therefore, under a simpler form. I looked upon the tube as a hollow girder, whose strength was dependent upon the same causes as that of any other, and I saw plainly the direction my experiments should take and the principle by which I was to be guided. That determined opposition which I shall be found in this correspondence to have given to the use of chains or any other flexible auxiliary for the support of the tube, dates from this period.

"'Millwall, August 6, 1845.—My Dear Sir,—For the last eight days I have been constantly employed on the experiments, and although some of them have not always indicated the results expected, they are nevertheless not only useful as regards the object of our research, but highly satisfactory. From these investigations we derive several important facts, one of which I may mention, namely, the difficulty of bringing the upper, as well as the lower side of the bridge, into the tensile strain. For this object several changes were effected, and attempts made to distribute the forces equally, or in certain proportions throughout the parts, but without effect, the results being in every experiment that of a hollow beam or girder, resisting, in the usual way, by the compression of the upper and extension of the lower sides. In almost every instance we have found the resistance opposed to compression the weakest, the upper side generally giving way from the severity of the strain in that direction. These facts are important so far as they have given rise to a new series of experiments, calculated to stiffen or render more rigid the upper part of the tube, as well as to equalize the strain, which, in our present construction, is evidently too great for the resisting forces of compression. I entertained hopes of seeing you here before now, as I was anxious to show you the more interesting portion of the experiments, and to have had the benefit of your suggestions and advice. As it is, and under present circumstances, I trust I have your permission to pursue the inquiry, and to introduce such new forms and combinations as will fully determine the law of resistance, and also the strongest form of tube, when acted upon by a force calculated to crush or tear it asunder. I am leaving by this evening's train for Manchester, and will again return to the experiments in about a fortnight, or as soon as the additional tubes are prepared; in the meantime, you will probably report progress, as some of the directors and secretary were here on Saturday for that purpose.—I am, &c.,

"'R. Stephenson, Esq., C.E. W. Fairbairn.'

"It will be seen by this letter that the weakness of the tube had been recognized in its upper surface, which yielded to compression before the under side was upon the point of yielding to extension; and that the course which the experiments henceforth took of so strengthening the upper surface, that it should not be on the point of yielding to compression until the under surface was about to yield by extension, had been already shaped out. This state of the tube was a condition necessary to the greatest economy of its material, for in any state in which it was not on the point of yielding on the one side at the instant it was on the point of yielding on the other, some of the material might be taken from the stronger side without causing that to yield, and added to the weaker so as to prevent that side from yielding, and thus the tube would be rendered stronger by a new distribution of its material. It was with a reference to this principle that the rectangular form of section had suggested itself to me, in the place of the circular or the elliptical forms proposed by Mr. Stephenson, and that I had ordered the top of the tube to be thickened. It now occurred to me that the top might be strengthened more effectually by other means than by thickening it, and I addressed the following letter to my son, four days after the date of the last, directing him to cause two additional tubes to be constructed, the one rectangular and the other elliptical, with hollow triangular cells or fins to prevent crushing. These experiments led to the trial of the rectangular form of tube with a corrugated top, the superior strength of which decided me to adopt that cellular structure of the top of the tube which ultimately merged in a single row of rectangular cells. It

SIMS'S PATENT
DOUBLE CYLINDER COMBINED PUMPING ENGINE,

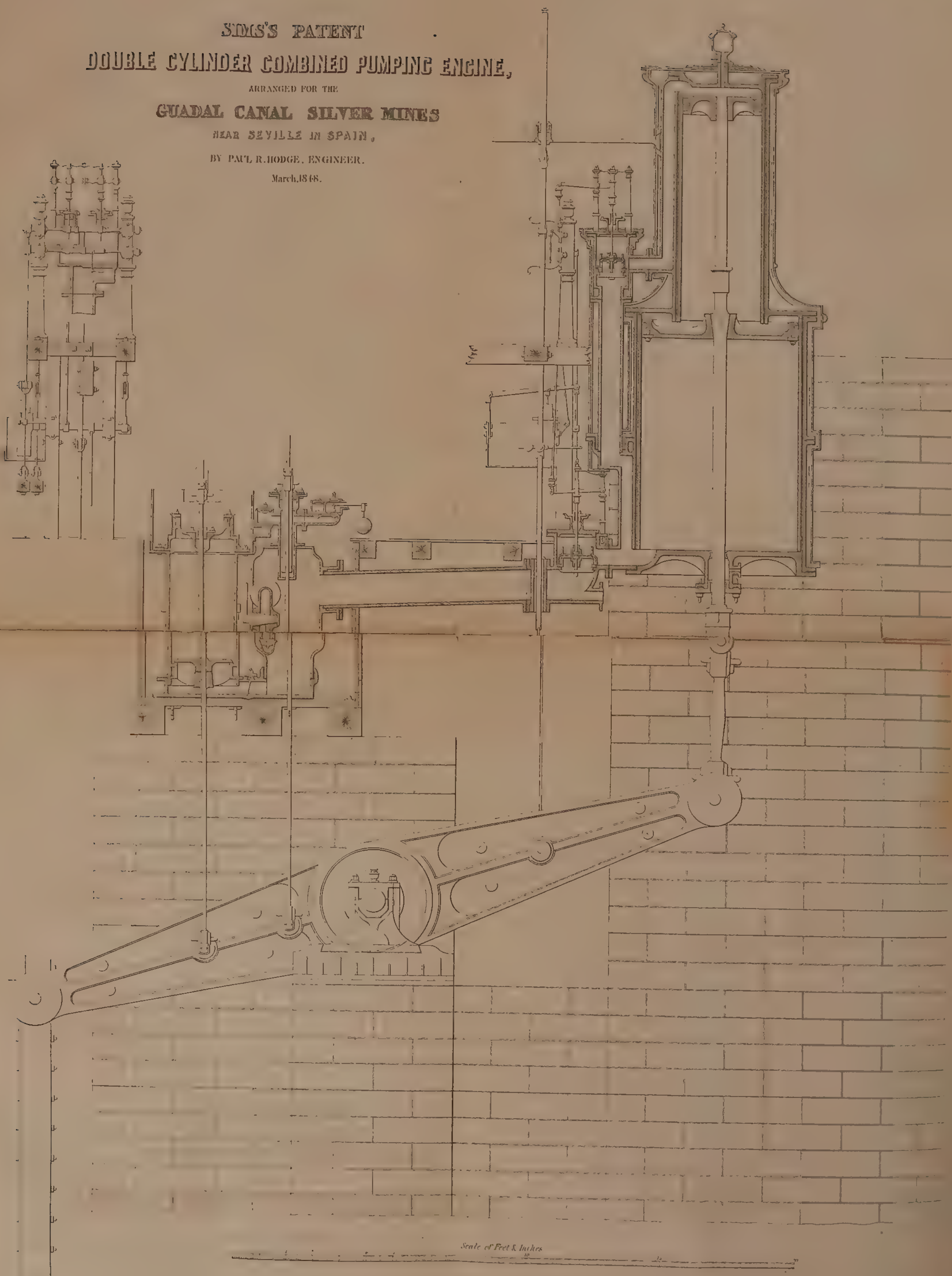
ARRANGED FOR THE

GUADAL CANAL SILVER MINES

NEAR SEVILLE IN SPAIN,

BY PAUL R. HODGE, ENGINEER.

March, 1848.



is this cellular structure which gives to the bridges, now standing across the Conway Straits, their principal element of strength.

"'Manchester, August 10, 1845.—I shall require the following models made. One of this kind (see fig 4), composed of plates $\frac{1}{16}$th of an inch thick, the top, *a, a,* to be made of plates of the same thickness, but the middle part, *x,* may be left out, and filled up with wood, to give the top side stiffness. The joints of the plates below to be carefully made, with a stronger piece, double riveted, over these, in order to cause the plates to be torn

Fig. 4.

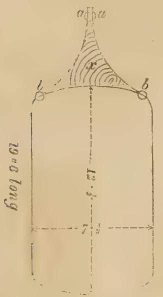
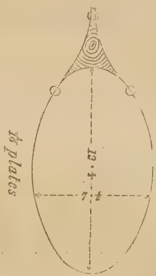
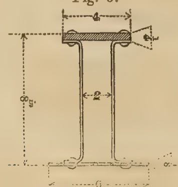


Fig. 5.



asunder instead of the joint. The top *a, a,* to be firmly riveted to the tube all the way along as shown at *b, b.* Another of the same kind to be made, of the same length and thickness of plates, but of this shape (see fig. 5), 19ft. 6in long. These may be made out of some of the old ones, after proper drawings have been taken of them. To be crushed or torn asunder with the weights suspended from the inside, as before. Also one small beam (see fig. 6), 12ft long, as under:—Thickness of top plate $\frac{1}{4}$ of an

Fig. 6.



inch; sides $\frac{1}{16}$th of an inch; bottom, $\frac{1}{8}$th of an inch. I think these will be all we shall require at present; and as soon as you are ready let me know, and I will be with you to see them tested.

"'T. Fairbairn, Esq. I am, &c., W. FAIRBAIRN.'

"The experiments had now assumed a shape which seemed to me to require the assistance of a mathematician who should deduce, if that were possible, a formula which, from the observed strength of a tube of a lesser, might enable me to calculate the strength of one of a greater, size; and conceiving that Mr. Hodgkinson, now Professor at University College, London, would not object to undertake the discussion of such a formula, I applied to him to do so, and invited him to Millwall to witness some of the experiments then in progress. Mr. Hodgkinson did not visit Millwall till the following month, being at that time engaged in testing some railway bars at the British Iron Works, South Wales.

"During Mr. Hodgkinson's first visit to Millwall (Sept. 19th, 1845), the whole of the experiments which had then been concluded were explained to him, and he carefully examined the apparatus which I had used, *On the first day of his visit, the tubes which had been constructed with single hollow or cellular tops were experimented on.* The forms of these tubes, and the results of the experiments upon them, are communicated to Mr. Stephenson in my letter of the 20th of September, which follows. One of them had a piece of fir timber fitted in the cell or fin, with a view to keep that part in form, and prevent it losing shape from the crushing forces; but in consequence of the difficulty which was experienced in making the timber accurately fill the whole space, it proved of little value. Superior results were however obtained from the increased surfaces which were offered to compression on the top sides by the fins, and my attention was naturally directed to the question, how far it was possible, by some other arrangement, better to accomplish the object of the cellular structure. Immediately upon the completion of the experiments on the 'fin' tubes, I ordered the preparation of another form with a corrugated top, resembling in section the eyes of a pair of spectacles, rightly anticipating from this form of tube a considerable increase of strength. The cellular form of top offered, however, according to the experiments already made, such decided advantages, that in the following letter I ventured to anticipate, even at this early period, an ultimate cellular form of section for the great bridge itself, and proposed to Mr. Stephenson two ideas, the one of a tube with a series of square cells on the top, as at *a, a* (see fig. 9), and the other with a number of circular pipes having flat plates rivetted to their tops and bottoms, as shown at A (see fig. 10). The reader will not fail to observe how much the first of these sketches resembles the tubes actually constructed for the Conway and Britannia Bridges. The whole of the arrangements for our subsequent proceedings were pointed out at the time to Mr. Hodgkinson, and appeared to meet with his approval.

"'[Private.]—Millwall, Sept. 20, 1845.—My dear Sir,—I have been uninterruptedly employed on the experiments for the whole of this week, and for two days I have had the benefit of the presence and assistance of my friend Mr. Hodgkinson. According to his views, as well as my own, we are progressing satisfactorily; and although we have not as yet arrived at the strongest form of tube, we are nevertheless approaching that desideratum. You will be aware, on referring to my last letter, that the great difficulty we had to encounter was a due proportion of the parts, so as to neutralize, or render the two resisting forces of compression and extension equal; out of nine experiments on cylindrical tubes, two failed by crushing in at the top, and seven by tearing asunder at the rivet-holes. The latter were, however, fractured, owing to the closeness of the rivet-holes and the construction of the tubes, the foreman having omitted to cross the joints. From eleven experiments on rectangular tubes, eight yielded to the crushing force, and three only were torn asunder by extension. The elliptical or egg-shaped tubes invariably failed, with only one exception, by compression; four having been crushed in at the top, and only one torn asunder at the bottom. Collectively, these appeared to indicate weakness on the upper side of the tube, and a necessity for a change of form in order to give rigidity and stiffness to that part. To counteract the forces of compression, I got two tubes constructed of the annexed forms; one elliptical, with a deep fin, *a, a,*

Fig. 7.

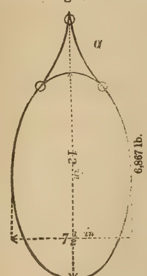
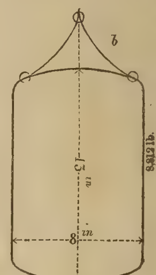


Fig. 8.



on the top, and the other rectangular, with a similar fin at *b,* as per annexed sectional sketch. These were according to the dimensions here marked, the one 12 by $7\frac{1}{2}$ in., and the other 13 by 8 in., and 18 ft. 6 in. between the supports. The plates were $\frac{1}{16}$th of an inch thick, and the tubes broke or were crushed respectively with dead weights of 6867 lb. and 8812 lb.

(To be continued.)

AITKEN'S PATENT IMPROVEMENTS IN THE STEAM ENGINE.

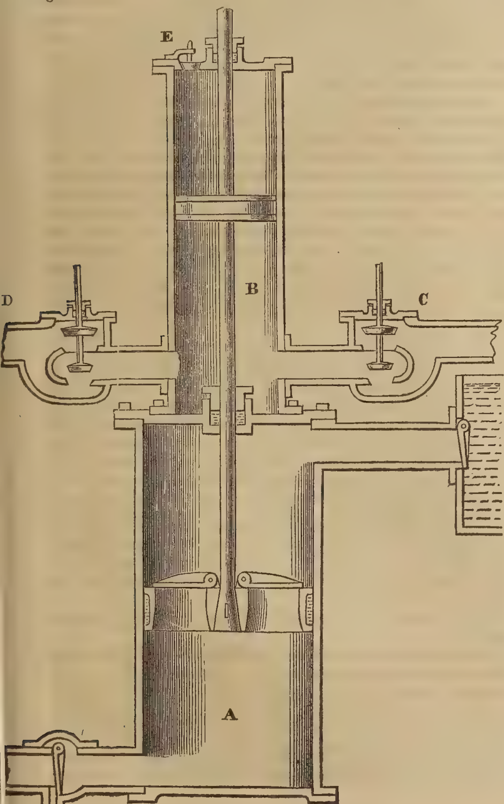
(Continued from p. 170.)

The engraving shows the application of an atmospheric cylinder to the ordinary air-pump, by which all the power required to work the air-pump (*minus* the friction) is saved.

A, is the ordinary air-pump; B, the atmospheric cylinder, with a piston working in it, on a continuation of the air-pump rod. C, is an equilibrium valve, which allows the condensing water to pass into the cylinder B, on the up stroke. D, is another equilibrium valve, which allows the water to pass from the cylinder B, into the condenser, on the down stroke. The valves C and D may be worked by the eccentric, which works the slide. E, is an escape valve, which allows any air or water to escape that may leak past the piston.

On the down stroke, the valve D being open, the piston will descend without any resistance, and on the up stroke, when the valve D is shut and the valve C is open, the water will be forced into the cylinder by the atmospheric pressure of 15 lbs. per square inch, and the load of the air-pump taken off the engine. On the down stroke, the water escapes into the condenser in the usual way.

By this arrangement, when applied to marine engines, the most fruitful source of accidents is removed, as the engine can never become choked with water, the necessary quantity being measured out exactly in proportion to the power of the air-pump to remove it. In the next number some account will be given of the application of these inventions, and a statement of the improvement which they have effected in the working of land and marine engines.



PATENT CORRUGATED CAST IRON WHEELS.

In the manufacture of wheels for railway purposes, as our readers are aware, there are various methods of combining the spokes and boss, the plan most patronised, perhaps, being that of forging the spokes with arms, which are welded together to form the inner tyre, and then running a cast iron boss round the inner ends of the spokes; or, what is considered a superior plan, by welding together the inner ends of the spokes, and forming a wrought iron boss. Both these plans render a separate tyre necessary, and both of them are so expensive as to render a more economical arrangement desirable. In our last number we gave a detailed account of Mr. Smith's solid, or disc wheel, which is a beautiful specimen of skill in forging; we now have to present to our readers a cast-iron wheel, which claims some of the same good qualities as the disc wheel, and at a diminished cost. These wheels have been extensively used in America, and are now undergoing trial on the North Western and Midland Railways, with favourable results.

Fig. 1 is a face view and section of one of the wheels, the details of which explain themselves; fig. 2 being a section across C C, and fig. 3 a section across B B.

Fig. 1.

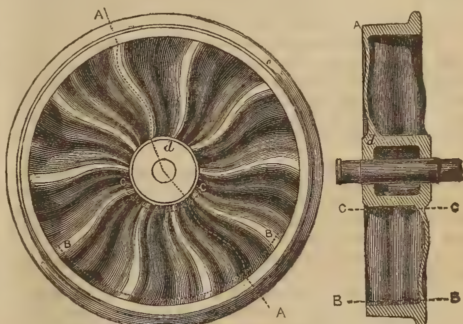


Fig. 2.

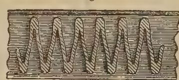


Fig. 3.

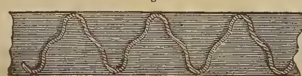


Fig. 4 is another wheel in which feathers, *d d*, are introduced to give increased strength: fig. 5 being a section across F F, and fig. 6 across E E.

Fig. 4.

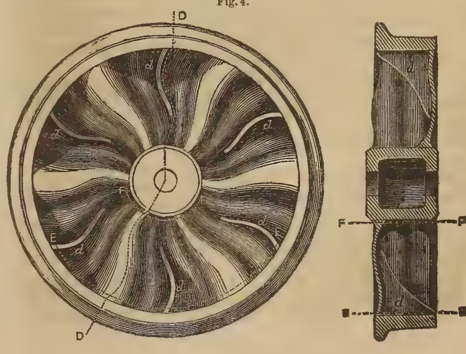


Fig. 5.

Fig. 6.

It is proposed to harden the tyres of the wheels by casting them in a chill, by which great durability will be acquired. The wheels being of equal circumference, do not require turning, and the necessity and danger of shrinking on wrought iron tyres is avoided.

BOARD OF ADMIRALTY.

To the Right Hon. Lord John Russell.

My Lord,—I dare say you think it great presumption in so humble an individual as myself addressing her Majesty's Prime Minister, but I can assure your Lordship I am actuated by no other feeling than the public good. I have tried all other means of correcting the evils, that are now evident to everybody, in vain, and I fall back on your Lordship as the last resort.

If your Lordship doubts any of the statements I made in my last letter, it would be very easy to expose them; but, my Lord, they stand uncontradicted, for I do not call the letter of the Duke of Portland any contradiction at all; and the press, with the exception of one paper, supposed to be the organ of the Admiralty, acknowledges their correctness.

It is now my duty to explain to your Lordship the causes of the evils of which I complain.

The whole mischief proceeds from the constitution of the Board of Admiralty; and even if your Lordship, with all your talents, were to place yourself at its head, constituted as it now is, and choose the cleverest men in the navy to assist you, I do not believe you would mend the matter. Bad as the naval administration was before the Navy and Victualling Boards were abolished, it is ten times worse now. The Admiralty have taken upon themselves more duties than they can perform—hence the delays, blunders, confusion, and waste; and I am quite certain had the Navy Board, bad as it was, been in existence, they never would have permitted, without remonstrance, the wasteful extravagance that has been incurred by the various Admiralty Boards since their extinction.

What Sir George Cockburn, Sir George Clerk, and, I believe, Sir Byam Martin, foretold, has come to pass. There is no responsibility whatever. So the responsibility of six gentlemen comprising the Board of Admiralty is not worth a straw. May I ask your Lordship who is responsible for the millions of money thrown away in building an inefficient steam navy—who is responsible for the iron steam fleet that the Admiralty do not know what to do with? It was only the other day that, raising a tank and the dunnage under it, in one of those precious vessels, they found a hole in her bottom, through which the water passed, and a *fish* with it, on which, if I am not mistaken, one of their Lordships breakfasted.

Who is responsible for (I believe) four frigates of 800 horse engines that they do not know what to do with, and pay annually for taking care of?

Who is responsible for all the bad ships that have been built and broken up in the last fifty years?

How comes it that the best two-decked ships we have are copies from the French?

Who is responsible for all the cutting and carving of ships' bows and sterns for turning four line-of-battle-ships and as many frigates into screws, before trying one—three of which, after three or four years' bungling and an enormous expense, are now ready, the rest were suspended by the present board?—though "Beta," who writes in one of the morning papers, and whom I shall reply to by and by, regrets they were not all brought forward. If I am not mistaken, he will turn out to be one who had a considerable hand in these ships, and in the construction of the iron fleet.

Who is responsible for allowing so many ships to be built after the plan of the late Surveyor, which is now abandoned? Either his plan is good or bad. If bad, why were so many ships built after it? If good, why is it discontinued? Why are the ships laid down by the late Surveyor (and not too far advanced) pulled to pieces to be built after another plan?

Who is responsible for carrying on the construction of some of these ships (ordered to be stopped) till too late to alter them? Absolutely nobody; the greater part of the individuals composing the different boards are dispersed, some dead, some out of political life, few left of so great a multitude. Had the First Lord of the Admiralty been a naval officer, the country would have fixed the responsibility on him—he could not escape; but it would be unjust to throw the blame on a civilian who does not know whether a butcher's tray or a washing tub was the best form for a man of war.

I shall be told the naval officers are there to instruct him. I can only reply that experience has proved that it does not answer. Why, then, should it be continued?

I am quite aware that it is useless to endeavour to persuade your Lordship, and, indeed, any other Prime Minister, that a naval officer ought to be at the head of the navy, as a military officer is at the head of the army. Ministerial men will never give up the prize of First Lord without a struggle; it is quite unimportant whether they are fit for it or not.

The present First Lord is a very good man, and I believe a good man of business; but he has been brought up in quite a different line: he has been in the Treasury and Chancellor of the Exchequer, and all he can know about naval affairs is his having represented Portsmouth for a good many years. What would be said of a Prime Minister, were he to take a sailor, one of the Lords of the Admiralty, and make him Chancellor of the Exchequer without having the least experience of finance? But one is not a bit more ridiculous than the other.

Why should naval officers be held in such low estimation by Ministerial men that it is never thought proper to place one at the head of his own profession? I am satisfied it is a great mistake; but so it is. And I must just take things as they are, and endeavour to improve them, which, after all, I do not consider very difficult. The first step to improvement would be to reduce the Admiralty to three—a First Lord and two others, who should, for the time being, be Vice and Rear Admirals of Great Britain.

They should appoint a naval officer Surveyor of the Navy during pleasure (but not to be removed, as a thing of course, by a new Ministry); this officer should have the entire management of the dockyards, and under him should be a deputy-surveyor, whose principal duty should be the storekeeper's department. The medical and victualling department should be under a naval officer also.

These officers should be frequently in the dockyards and victualling and hospital departments, and not pass through them with railroad speed as the Admiralty now do. The Accountant-general at the head of his own department should be the Chancellor of the Exchequer of the navy, and exercise a wholesome controul over the expenditure. All these departments should be under the same roof; every man should be within hearing of the board-room bell—no running backwards and forwards to Somerset-house, losing time, and paying messengers and numerous additional clerks.

It may be said, with the exception of being under the same roof, that is the present arrangement; that the Admiralty is divided into departments, and a lord has charge of each. But, my Lord, they are not responsible. They do not, and cannot, give their undivided time to the department. They all meddle with and control one another. They have no distinct power and no distinct responsibility. I would give the power to each man in his own department, and he should be responsible to the Admiralty and the country.

Let us examine how things are carried on now in the surveyor's department.

He has six masters, each of whom he is obliged to consult individually. If it is about repairing or fitting out a ship, he goes to the first sea-lord; if about building, to Lord John Hay; if about the guns, to Captain Berkeley; if about the packets, to Mr. Cowper; if about the dockyards generally, to the First Lord and the Secretary; if about stores, to Captain Milne. More than half of his time is occupied in running about from the Admiralty at Somerset-house to the Admiralty at Whitehall. If he wants to see the First Lord, he may be at a Cabinet Council; if any of the other

lords, or the Secretary (during the sitting of Parliament), they may be in committee; and all his day is lost.

Should the admiralty require a plan or an estimate—which, by the by, they do now for every trifle—they write to Somerset-house, who again write to a dockyard; the dockyard sends the plan to Somerset-house, who put something on the cover of the letter, and send it to the Admiralty; they put a scratch upon it, and send it back; it gets another scratch, and returns to the Admiralty. Somerset-house is then ordered to write the letter; it comes back to the Admiralty to be signed, and is then finally despatched. Should there be any mistake it is returned, and performs the same number of voyages over again. I believe this system runs through all the departments, and, if I am not mistaken, the various scratchings on the letter are much oftener made by the clerks than by their Lordships. Now, my Lord, consider all these delays, consider the number of clerks who must be employed to carry on this correspondence; and after all who is responsible? Absolutely nobody.

I would abolish that system. Let every man be held responsible for his own department, and let the Admiralty superintend the whole; they will have enough to do without going into details—which they cannot do, and which the clerks are obliged to do for them. There is no want of talent in the country, a better man cannot be found for the surveyor's department than Sir Baldwin Walker. Give him rope enough, and I will answer for it hundreds of thousands of pounds will be saved, and there will be no more bungling. When a ship is ordered to be built, he will send for the builder and explain to him what is wanted: if that builder performs his task badly, put him out, and get a better. Do away with all your planners at Somerset-house; let your surveyor consult the practical men at the different ports; instead of running backwards and forwards to Whitehall, let him go to the dockyards and leisurely examine what is going on, and not run through them as the Admiralty do now; give more power to your superintendents of dockyards and a great deal less office work; when ships are commissioned, put a stop to all changes at the whim of every commander, and teach them to keep their own ships in repair, do at home what they are obliged to do abroad—viz., take care of their own ships—and where are they in such good order? On the home station, if you fit out a ship to the eastward, the probability is, if she touch at Portsmouth she has a long list of defects. Make them good, and send her to Plymouth, there will be another list. Put a stop to all that. I know from experience it can be done. Let every captain have an account of the annual expense of the ship. Show favour to those who sail their ships with the greatest economy, and avoid employing those who sail their ships expensively. Be assured a reform in that respect will speedily take place.

Whether your Lordship will approve of these suggestions or not I cannot tell; but unless things are mended I feel quite certain the country will get tired of giving money to the navy to be expended without doing good. Thousands of pounds might be saved in your dockyards. That is where you ought to economise, not in paying your seamen, whom you have encouraged to come into the service, and whom you may want when least expected.

THE STEAM NAVY.

To the Editor of the Times.

SIR,—I do not much like replying to anonymous letters, one of which has appeared in a contemporary journal under the signature of "Beta;" but, as I have reason to think I know who "Beta" is, I shall make an exception in his favour. As I am not in the secrets of the Admiralty, though I expect he was, I do not know who the Admiral is to whom he alludes as having given opinions diametrically opposite to mine. As I have not seen those opinions I cannot reply to them. As to his sneer at my saying I had greater experience than most naval officers in the construction of steam-vessels, I shall merely observe that that observation applied to a time when steam was little known, and when I had constructed no less than six steam vessels, four of which were of iron, and I bought my experience at a tolerably high price.

"Beta" has brought the Prince de Joinville to his assistance; but the Prince wrote in 1844; I wrote in 1849, and notwithstanding his opinion, I have no hesitation in saying there is no comparison whatever between the large French steamers and ours. I have seen them both, and though they are very far from perfection, they would blow ours out of the water. But the question is not whether steamers should carry broadside guns; it is,—are our steamers constructed to carry broadside guns, having ports and bolts fitted for that purpose, capable of carrying them or not? It is well known they are not, therefore they are failures; but the Admiralty themselves settled the question of broadside guns, because they lengthened a 46-gun frigate 60 feet with the hope of her carrying them, and they have since been removed. "Beta" says this was done "in order to admit of the crew being more conveniently berthed on the main-deck, while serving on the pestilential coast of Africa." I think "Beta" had better have kept that to himself. A pretty frigate, indeed, that is obliged to have her guns removed to lodge her people! They also built the *Terrible*, *Sidon*, *Odin*, and *Leopard* to carry broadside guns, and the *Retribution* is going to Woolwich to take a smaller engine, in order that she may do so also, and perhaps we shall be told by-and-bye this is done to give better lodging to the crew.

In addition to this, I believe all those now on the stocks, and capable of carrying main deck guns, are to be so armed; but they are too small; not one of them will have a clear main deck, and not one of them will have good stowage; and I do think, that after all that has been said and written, and with the experience we have had, the present Admiralty deserves great censure for having laid those vessels down on their present plan; and I do hope and trust that they will put a stop to such a system of construction, which has continued too long, and cost the country enormous sums of money.

I now come to the screws. "Beta" says the *Termagant* and *Dauntless* are armed with 24 guns, being ten more than the *Sidon*, have a greater horse-power, and are now ready for commissioning. I will show how little "Beta" knows about the matter, and I will also show that the *Termagant* is as great a failure as any of them. In the first place, she is not ready for commissioning. She was built at Deptford, had a great part of her fittings done at Mr. Young's yard, and came round to Portsmouth to get bulwarks put on her quarter deck to protect her people from musketry, which they had forgotten to do at Deptford, and all this at a very great expense; she is of 1,450 tons, has a 620-horse engine, which occupies 85 feet, stows only 222 tons of coal in her coal boxes, six weeks' provision for 320 men, and 53 tuns of water; she has no after magazine, no cockpit, and can only berth 120 men; she mounts four 10-inch guns, and two 8-inch on the upper deck, and 18 32-pounders on the main deck, and is said to go 10 knots. She is the most perfect thing of that kind I ever saw, and, had she been properly built, would have mounted 40 guns.

The *Sidon* is only 1,327 tons, did mount 14 32-pounders on the main deck, and four 56-pounders on the upper deck, and is now to mount 16 68-pounders on the main deck, six 68-pounders and two 10-inch guns on the upper deck; has a clear main deck, with the exception of the shaft; can berth her crew below; carries three months' provisions, and 75 tuns of water; has an after magazine and cock-pit; can stow nearly 700 tons of coal in her boxes; has excellent stow room, is a complete frigate, and will walk round and round the *Termagant*. I have not examined the *Dauntless*, but so far is she from being ready for commissioning, she is now in dock to be lengthened by the stern, and when they are both finished they will be very imperfect, and would have been much more efficient had they had engines of 200 or 300 horse power. So much for building two vessels before trying one.

I should like to know where does "Beta" find exactly double the number of steam-frigates at sea, or ready for commissioning, to what has been represented by Sir Charles Napier in his first letter?

Is the *Penelope* one of those whose guns are removed, as "Beta" says, to berth her men more conveniently, but, as I say, because she cannot carry them? As both the *Sidon* and she will be ready about the same time, I shall have an opportunity of proving that he is wrong and I am right.

The *Termagant* is, I suppose, one of them; but she is in course of getting bulwarks on her quarter deck, and is not ready for commissioning.

The *Dauntless* is one that is now in dock to be lengthened, and she will probably not be ready for commissioning these three months. I must, however, thank the Admiralty for following my advice in taking the steamers in hand, and I wish they would go a little further, and put every shipwright we have upon them, such as they are, and get them finished; but, even when the *Dauntless* and *Termagant* are finished, though full powered, they will not be so efficient as the *Arrogant*, which is only auxiliary, or the *Amphion*, the latter of which had her bows altered twice at an expense of

£7,000 or £8,000 (and I strongly suspect "Beta" had a hand in it), and after two years' bungling was at last made to go tolerably well by the great exertions of Mr. Dinnen. Her main mast was stepped in an iron stanchion, which began to give way, and was obliged to be repaired; had it broken, the mast would have gone through her bottom. She was paid off last year, and, I suppose, has been in the hands of the doctor ever since.

"Beta" says, "it is quite possible that some of our other steamers, armed as they are with guns of the heaviest calibre at the extremities, might prove not unequal to contend with those of France, especially with such of them as, like the *Gomer* and *Asmodeé*, have been reduced to the somewhat awkward alternative of leaving, when sent to sea, either their guns or their coals behind them."

May I ask "Beta" whether he forgot, when he wrote this, that in the preceeding paragraph he told us the *Penelope* left *her guns behind* to berth her crew more conveniently?

I was not aware that I had omitted any of the wooden steam corvettes; but, on looking over the list, I find I left out the *Basilisk*, *Desperate*, *Fury*, and *Geyser*. But, to counterbalance that, I gave in my list the *Phœnix* (a screw), *Urgent*, and *Triton*, neither of which is a corvette; so that, in number, I was only one short.

The following, which have been published in a morning paper celebrated for its scurrility—*Alecto*, *Archer*, *Firefly*, and *Prometheus*—cannot be considered corvettes. The *Magicienne* is just launched. The *Niger*, *Encounter*, and *Rattler* are screws, and the *Rhadamanthus* is a trooper; so that I was not much mistaken, and they came under my observation, "that, in addition to these, the French have 52 steam tenders from 20 to 160 horse-power, and we have also a number of small craft of various sizes, I believe superior to the French."

I omitted the screws of both nations, as I think they can only be looked upon as auxiliaries, of which more by-and-bye. I was not aware that the French had been so foolish as to construct iron vessels. "Beta" says they have built five, and thirty are building. That may be a consolation to "Beta," but it is none to me, and only proves that the French Admiralty are just as injudicious as the British Admiralty. As "Beta" still sticks to his iron vessels, he had better read Captain Chad's evidence, who was witness to the experiments tried upon them. "Beta" allows that the *Sidon* has some virtues. I wish I could find any in the iron vessels to recompense us for their enormous expense. Had "Beta" a seat in the House of Commons when I warned them against building powerful iron steamers, when the Secretary of the Admiralty said "We are building forty," and was cheered by his friends,—was "Beta" present?

He says I disposed of the steam guard ships, by far the most formidable of our naval defences, in a single line. Now, I think I know more about these vessels than "Beta" does. I have had two of them under my orders, and know what they can do. They have been called "steam block ships" and "steam guard ships." Now, they are neither one nor other. Had they been block ships, they ought to have been heavy-armed hulks, and a steamer could move them about when wanted. Had they been guard ships, they would have been better without engines and much less expensive. They are sailing ships with an auxiliary screw, and, in the event of a war, would be the first ships sent to sea. They would be the advanced squadron of a fleet, and in light winds they would use their screws and bring an unwilling enemy to action, and if engaging a willing enemy they would be kept in reserve ready to throw their whole force on any particular point they might be wanted, and as such they will be most useful vessels; but there was no excuse for the Admiralty at once cutting up four line of battle ships and four frigates without trying one. Three line of battle ships are persevered in, two are now finished, after three years bungling, at an enormous expense, and a third is about being tried; I should then like to see the bill.

The *Amphion*, I believe, is the only frigate finished, the present board having suspended the others, not being desposed to run hurry skurry into such enormous expenses without previous trials, much to the regret of "Beta."

It is not necessary for "Beta" to refer to the Report of the Committee on the Navy Estimates to know that eight of these vessels were ordered to be cut up, for I strongly suspect he himself signed the order. "Beta" is quite correct in supposing I meant these ships "as being good sailing ships converted into bad steamers." They are bad steamers in many respects, and have cost thousands of pounds; and it would have been much better to have built one or two line-of-battle ships for that purpose, and they would have been as far superior to the present ones as the *Arrogant* is to the frigates that were cut up, and I trust nothing will induce the present board to permit any more experiments of the same nature. They are, I know, trying their hands on the *Sanspareil*, laid down for a line-of-battle ship, but now lengthened for a screw frigate, and I trust they have well considered the subject. I hope the builder and the engineer have been brought together in the presence of the surveyor, who, I am sure, would put them right; though that has not yet been done as regards the *Leopard*, notwithstanding all the warnings they have had.

I now take leave of "Beta," and I recommend him to turn his hand to some other trade, for that of ship-building he knows nothing about, and is too old to learn. If he is inclined to continue this controversy he ought to sign his real name, which would give him more weight with the public if right, and, if wrong, he must take the consequence.

I remain your obedient servant,

Charles Napier.

THE MERCANTILE STEAM NAVY.

ANALYSIS OF EVIDENCE.

(Continued from page 177.)

Mr. John Ronald—Questions 542 to 595.—Is a ship builder and has been captain of a steamer. The expense of strengthening a steamer to carry guns would depend on the original build. A vessel of 500 tons, of common class build, would cost about £500 altering. Larger vessels, more per ton, up to two guineas. Opinion that there would be no difficulty in strengthening the vessels. Was builder of the *Royal William*, and *Royal Tar*, the largest ships afloat at the time. Builds vessels now which beat the government vessels in speed. A merchant steamer carries more weight than a ship of her class in the Navy. Agrees with Mr. Pitcher that a due arrangement of the material is of the first importance. The main mast of the *Bombay* is 81 feet and the main yard 72 feet. No vessel of that class in the Navy has larger spars. Nor is there much difference in their rigging and area of sails. It is a fancy of the Government to make their vessels sharp floored and of greater draught of water, but draught is not necessary to give stability. Colliers sail as well in ballast as when loaded, even in going to windward, but that is a part of ship-building they have not found out nor adopted in the Navy yet.

Captain W. H. Henderson, R.N.—Questions 596 to 792.—Has commanded steamers in the Navy for 9 years. The first was the *Phœnix* of 876 tons and 220 horses power, on the coast of Spain. She was employed in carrying troops and has had 1250 on board, in excessively bad weather; in fact, it was attended with great danger, but it was done. Under very favourable circumstances, I have got 11 knots out of her. Against a strong head wind in a moderate sea, about seven and a half. She was built about 1831, with the *Rhadamanthus* and *Salamander*; they were all good boats.

Was appointed to the *Gorgon*, of 1110 tons and 320 horses power. She is a remarkably strong vessel with spacious decks. I had 1600 marines and artillerymen with six field pieces and limbers on board of her on the coast of Syria. Her speed would be 9½ to 10 knots, under favourable circumstances. In steaming head to wind with all the masts and yards up, it might make two to three knots difference if they were struck.

Was appointed next to the *Sidon*. She is the best steam vessel I ever saw. Has had 500 men drawn up on her decks at once. She is 1330 tons and 560 horses power. She could take 700 tons of coals which would last 20 days at full speed. She was rigged as a barque and would spread as much canvas as a 32-gun frigate—more than any other steamer I ever saw. She bore her armament so well that I have recommended a still heavier one. In cruising, without steam, she kept company with the *Canopus*, line-of-battle ship. Has never tried the *Sidon* with merchant steamers, but has had 12½ knots with 300 tons of coals. Agrees with a report by examiner (Lord John Hay) as to the good qualities of the *Gorgon* in sailing and steaming. The *Odin* is about equal to the *Sidon*. The *Leopard* was laid down as a duplicate of the *Odin*, but was suspended

until the latter was tried. (See Admiral Napier's letter, p. 147.) Has been in action in a steamer with batteries, but not with another steamer. Against batteries they answer admirably because you can fight with steam down. Opinion that in a general war, large steamers would be available against line of battle-ships, because the line-of-battle ship would be taken on her weak points by the larger guns of the steamer, which would keep at a distance, and could elevate her guns more than a sailing vessel could do. Opinion that steamers might be brought into broadside action, and would not be so vulnerable as people generally fancy. That in half an hour a line-of-battle ship would be very much crippled by a steamer, if it were calm or a light wind. If the line-of-battle ship had an auxiliary screw, she would be a more dangerous enemy, but the steamer of superior speed would still have the advantage. In case of a battle, each ship of the line should have a steamer to tow her into position. In the first of the war we ought to have a number of light fast steam vessels to protect our trade, and act as privateers. Opinion that there is an end of blockades because men-of-war could always be towed out by steamers, when the blockading fleet was blown off shore. Blockading would become an observation by steamers.

With reference to arming large merchant steamers, it is a great mistake attempting to put large guns (of 80 cwt. and upwards) in vessels that are built of light material, without immense strengthening. I am quite sure that merchant steamers are not near so strong in the scantling as government vessels generally. Other witnesses may have stated that the vessels lighter forward and aft, are better suited for carrying guns, but they cannot be better, if the scantling is lighter. Opinion that since the new regulations a better class of engineers have entered the sea-service. Mr. Ward was chief engineer of the *Sidon:* he was brought up at Liverpool, and is the best engineer I ever met with afloat. Merchant steamers, with their present masts and yards, would be unable to keep up with a fleet. The masts of vessels in the navy prevent them steaming so well, but there is a great economy resulting from it, because they frequently sail for months without steaming at all. If a merchant steamer could perform 10 knots with sail alone, she would be able to accompany a fleet on ordinary occasions.

Captain Berkely, R.N.—Questions 753 to 756.—Hands in extract of a letter from Mr. Jago, chief engineer of the *Sampson,* stating that they had beat the *Tweed* considerably in a run to Madeira, and had done 12 knots in smooth water, the engines making 18½ revolutions, and that she is a beautiful sea boat. Believes that the French Steam Navy consists of 114 vessels and 25,970 horses power, irrespective of those building.

Captain Samuel Lewis.—Questions 757 to 828.—Has been at sea 34 years, and with the P. and O. Co. since its commencement. Took the *Malta* out to Ceylon. She is 1225 tons, and was under sail almost the whole of the passage. Her greatest speed, under sail alone, was 9.6 knots. When the floats were taken off she did 10 knots. She was uncommonly stiff and weatherly, and if she had had larger spars, she would have done two knots more; the floats could be taken off in one hour and forty minutes, and replaced in the same time. She was three months and eight days from Southampton to Ceylon; the *Bentinck* averaged 10 knots from Calcutta to Suez. Opinion that there would be no difficulty in adapting these superior vessels to war purposes; that they would be very efficient in carrying troops and coals, and that the engineers and crews would enter the service when required.

Mr. Andrew Lamb—Questions 829 to 887.—Is superintendent engineer to P. and O. Co. Opinion that the engineers of the private companies would volunteer at a moment's notice if the veseels were required for H. M. Service. There would be no difficulty whatever if a provision were guaranteed the same as the engineers in the navy have.

It would be quite practicable to place the boilers and steam chests in merchants steamers below the water line, and it would not interfere materially with the stowage. In our first class vessels like the *Hindostan,* there is 10 feet of coal between the steam chest and the ship's side. In this vessel I should imagine the engineers to be safer than in any of H. M. Steamers I have seen, because a body of coal is carried between the boilers and engines, against which the force of the steam would spend itself in the event of an explosion; the stokers would suffer most. The engineers and stokers would not be so safe from shot as if the engine room were below the water-line. The coal that protects the boilers is left till the last, and by the time that is wanted, it is time to look out for a coaling port. But if you were to meet with the enemy just as you were going into port, your boilers would be nnprotected certainly. The Peninsular and Oriental Company do not do their own repairs, either to ships or machinery. It is more economical to employ private individuals. The machinery made at Woolwich cannot be better than ours, and should not be worse. Has never found any obstacle in getting the repairs done efficiently and with readiness. The annual expenses on a vessel and machinery amount to 7 per cent. on the total original cost.

Captain Henry Dicie Chads—Questions 888 to 1010.—One of the first steps that this country ought to take should be to induce the owners of merchant steamers to come into the views of this committee. It would give us time to arm our steam navy. The minimum size of gun ought to be a 32-pounder. There are a vast number of vessels would carry our heaviest ordnance as auxiliaries. They would not in the slightest degree, however, supersede regular men-of-war steamers. From their rig they could not keep way without steaming, and consequently they would soon run short of coals.

Opinion that iron is very inferior to wood for war purposes. Has tried experiments with six inches of iron plates rivetted together, and the shot goes right through them all. To resist the shot they must be of such immense thickness that they would not float. The hole made by the shot going in is comparatively trifling; but the fracture on the opposite side cannot be repaired; and if a rib is struck, the ship must go down. The capacity of the Oriental Steam Company's vessels for armament is not very great: with a small armament they might make good auxiliary vessels for the defence of our own ports; or they might be useful for the conveyance of troops from one island to another. While the vessels of our steam navy, as it grew up, were considered only as auxiliaries, we have increased to such an extent in our steam, that they will become principals in all battles. There is hardly a circumstance that you can put a steamer under, in which it will not be an action with broadside guns. We attach too much importance to speed and forget the guns.

Has tested the capabilities of the *Blenheim.* (1747 tons and 450 horses-power). She is a most useful vessel for every kind of service. Her maximum speed under steam alone, good six knots. Towed the *Bellerophon* (2,000 tons) at 4¼ knots. We have nothing that would be equal to her as a man of war steamer. If I were in a 120 gun ship, I should not care for the *Sidon.* She dare not come under my guns. Supposing the line of battle ship in a calm, not having heavy pivot guns on deck, I should endeavour to capture her, if I were in the *Sidon;* but I believe you might fire away the whole ammunition of the steamer without hardly striking the ship, if you kept out of range of her guns, say 3,000 yards. In a calm, her boats would always keep her broadside on the steamer. Does not agree with Captain Henderson on this point. At 3000 yards, even under favourable circumstances, the steamer will not strike the ship above 8 or 9 per cent. Pivot guns have little advantage over 32-pounders in the lower deck of a ship, as to precision.

Even if merchant steamers were armed as proposed, the Government steamers could not be reduced; we have not the reserve we ought to have. Few of our steamers of war are equal to go alongside a French steamer. They have broadside armament, whereas many of ours are only armed at bow and stern. Our smallest steamers might carry a 32-pounder. Opinion that merchant steamers could not keep company under sail with a fleet. The *Blenheim,* under sails only, has been able to do so. The steam sloops carry two heavy guns—a 95 cwt. 68-pounder, and an 86 cwt. 10 in. gun, and four broadside guns, 32-pounders of 40 or 42 cwt. There is another class commanded by post captains, but they are not frigates, for they can carry no guns on the main deck (see Admiral Napier's letter, p. 147). The real steam frigates are those which have been built since 1843—the *Odin, Sidon,* and *Terrible,* and the screw vessels. An efficient armament both at the broadside and extremities is necessary. The French steamers carry 14 to 16 guns, but give up speed. A quicker vessel would have the option of being brought into action or not, but that will not do for Great Britain. Tried experiments on a wrought iron target at Portsmouth, and a small

steamer. From those experiments, should say the rends and the difficulty of stopping the holes would be greater with iron. The target had no ribs to it, but the plates were six inches thick. Opinion that the merchant steamers would lose speed after they had taken in their armament and spars. Is not aware that vessels of a comparatively small class will carry 50 tons of cattle on their decks, and do very well with it.

When a ball goes through the iron plate, it makes a great number of minute splinters. It is not difficult to stop the hole on the side it goes in, because the outside is clean; but, on the side it goes out, it is very difficult, for the hole cannot be stopped from the inside. Captain Charlewood has commanded an iron ship under fire, and has stated that the splinters were not so bad as with wood. In the experiments I tried with boilers and funnels, the splinters went through the opposite side.

Rear Admiral Sir Charles Napier—Questions 1011 to 1031.—Opinion that there ought to be a certain number of merchant vessels sailing out of each port of England, fitted with magazines and pivot guns, either one or two according to size, to be commanded in case of war by the same officers and men. That the fishermen and people at the different ports ought to be armed in the same manner that the sea fencibles were in former days, and named to a particular ship. That guns and ammunition should be on the spot, so that you could appoint naval officers to them and arm them simultaneously. If the guns were all kept at Woolwich, it would create great confusion if the vessels were all sent there, and valuable time would be lost if the guns had to be sent to the vessels. To add our merchant steamers to our navy, 6,000*l.* or 10,000*l.* or even more, would be well laid out. As regards the engineers being willing to serve when wanted, I can only answer that from the experience I had of four or five, many years ago, they all bolted as fast as they could, except one. They asked £2000 to be placed on the capstan head; they knew we had not 2000 pence. It was only an excuse.

Isaac Watts, Esq.—Questions 1035 to 1072.—Is one of the assistant surveyors of the navy. Produces drawings comparing the sails of H. M. steamers with Cunard's line and Peninsular Company's vessels. Opinion that the contract steamers might be made available as an auxiliary navy. Some of the windlasses, hatchways, and roundhouses, would have to be removed. The alterations could hardly be done in a fortnight—say from that to a month. The bulwarks would have to be raised and strengthened, and powder magazines and shell room fitted. These might be used for merchandise. No professional man would recommend putting a shell gun on top of the spar-deck. One of these vessels might carry from 800 to 1000 troops on a three days' voyage, if the cabins were cleared away.

Charles Wye Williams, Esq.—Questions 1073 to 1128.—Is manager of the City of Dublin Steam Packet Company, which owns 24 ships, of 10,837 gross tonnage, and 6,537 registered tonnage. Opinion that the owners of steam ships would strengthen their vessels and give government power to take them on an emergency on equitable terms. The average cost on a medium size vessel might be £500. The per centage on that amount payable by government ought to be 24 per cent. per annum. Say 8 per cent. for maintenance in order; insurance, 5 per cent.; depreciation 5 per cent.; and six per cent. profit. During 25 years' experience, has had much experience with engineers, but anticipates no difficulty in inducing them to serve, when called upon. Many would prefer it to the drudgery of the mercantile service; and if those on board would not go, other competent men would. I chartered two vessels for Don Pedro's service to his agent; they were under Admiral Napier's orders, and when he ordered the commander to tow him into action, the commander refused to do so, by my express orders. The vessels were not insured, and it was stipulated in the charter-party that they should not be exposed to shot. The engineers were very angry, when they came home, to find that any imputation had been thrown on them. None of our engineers were party to asking for any indemnity being laid down for them. Our vessels often carry very heavy deck-loads. One of the smallest has often carried on deck in bad weather two locomotives weighing 17 tons each. We have carried troops—a thousand men, with heavy baggage, besides women and children. In our mail boats, where the work is severe, we give our first engineer £2 15s.; to the second, £1 17s. 6d.; to the third, £1 8s. In the other vessels, to the first engineer, £2 10s.; to the second, £1 15s.; no third engineer.

J. R. Engledue, Esq., further examined.—Questions 1129 to 1163. Would give further explanation respecting the armament for merchant steamers. Second class steamers of 500 to 800 tons would carry a 68-pounder in addition to the 32-pounder on the quarter deck. There would be no difficulty in giving merchant steamers the same masts, yards and sails as similar sized vessels in the navy; they would be stiff enough with a little ballast or cargo at the bottom. Their speed would not be less than the vessels of the Navy. I have run 13 knots an hour for six or seven hours down channel with a steamer under canvas alone. The bulwarks might be planked inside and filled with cork shavings, &c., to protect the men. Opinion that the steam chest of the *Hindostan* would be well protected with 10 feet of coal on each side. Those vessels in the Navy which have their boilers below the water-line, would not be protected when the ship rolled. I have no doubt that the spar deck of the *Hindostan* could be strengthened to carry a 90 cwt. 10 inch gun. This is not entirely a shipwright's question, few shipwrights have ever seen a 10-inch shell thrown. Can show excellent testimonials for skill as a gunnery officer. Would particularly draw the attention of the committee to the *Bombay* steamer, which has been fitted to carry two 10-inch guns and 10 medium 32-pounders, and is in every way equal in fittings and efficiency to any vessel in Her Majesty's Service.

DIMENSIONS AND DETAILS OF NEW STEAM VESSELS.

THE SCOTTISH CENTRAL RAILWAY COMPANY'S IRON FLOATING BRIDGE "DOLPHIN."

Built and fitted by Mr. R. Napier, Glasgow.

Builders' Measurement.	**Ft. In.**
Length aloft	170 0
Keel and fore-rake	170 0
Engine space	38 9
Breadth of beam	34 0
Depth of hold	8 8
Tonnage.	**Tons.**
Hull	$921\frac{6}{94}$
Engine space	$243\frac{1}{94}$
Register	$678\frac{5}{94}$
New Measurement.	**Feet.**
Length on deck	167.6
Breadth on do. amidships	32.9
Depth of hold do.	8.4
Engine space	38.8
Tonnage.	**Tons.**
Hull	$417\frac{38}{100}$
Engine space	$116\frac{4}{100}$
Register	$301\frac{34}{100}$

Two steeple engines, without intermediate shaft, and unconnected, of 206 horse nominal power.

Cylinders 56 ins. dia. × 3 ft. 9 in. stroke; diameter of paddle-wheels, extreme, 21 ft. 11 in.; do., effective, 21 ft. 4 in.; floats 7 ft. 9 in. × 2 ft.; two sets of 18 arms; four floats in the water.

The *Dolphin* was constructed to carry the traffic of the Scottish Central Railway across the Tay, from Broughty to Ferry-Port-on-Craig. The trucks and carriages are run on board over a lighter, and a stationary engine is provided to draw them up an inclined stage at low water. There are three sets of rails on the deck, which is quite flat. The two sets of machinery, engine, boiler, and chimney, are quite distinct—one on each side of the vessel. Between the paddle-boxes is a platform, high enough to allow the locomotive chimneys to pass underneath, and fitted with two steering-wheels for the two rudders, one at each end, to obviate the necessity of turning the vessel.

The *Dolphin* was launched on the 6th of February last, and made her first trial trip on the 28th April. Her speed has been increased to 10 knots, which may be considered a very good result, considering the peculiar proportions and circumstances. The draught of water is only 4 ft. 3 ins.; but, when fully loaded with carriages, fuel, &c., it is estimated at 5 feet.

THE CORK RIVER STEAM NAVIGATION COMPANY'S IRON VESSELS, "PRINCESS" "EAGLE" AND "ROYAL ALICE."

Builders' measurement.	Princess.	Eagle.
	Ft. In.	Ft. In.
Length of keel and fore rake ...	132 9	102 0
Breadth of beam	18 0	18 1
Depth of hold	8 5	8 5
Length of engine space	36 5	30 10
Tonnage.	Tons.	Tons.
Hull	$210\frac{56}{94}$	$148\frac{84}{94}$
Engine space	$56\frac{87}{94}$	$40\frac{26}{94}$
Register ...	$153\frac{63}{94}$	$108\frac{58}{94}$
New measurement.	Ft.	Ft.
Length on deck	132·7	102·7
Breadth on ditto amidships ...	17·5	17·6
Depth of hold ditto	8·2	8·2
Length of engine space	36·4	30·9
Tonnage.	Tons.	Tons.
Hull...	$169\frac{1890}{3500}$	$167\frac{575}{3500}$
Engine space	$56\frac{175}{3500}$	48
Register	$113\frac{1715}{3500}$	$119\frac{675}{3500}$
Nominal h. p. (one steeple engine)	78	73
	Ft. In.	Ft. In.
Cylinder diameter	0 $48\frac{3}{4}$	0 47
Length of stroke	3 9	3 9
Paddle wheels, diameter, extreme ...	15 11	15 0
Ditto, ditto, effective	15 5	14 6
Length of floats	6 4	6 4
Breadth of ditto	1 2	1 6
Two sets of arms, No. in each ...	14	15

Princess.—8 strakes of plates from keel to gunwale; frames, $2\frac{3}{4} \times 2\frac{1}{2} \times \frac{3}{8}$, and 3 ft. $0\frac{1}{2}$ in. apart; draught of water, 3 ft. 9 in. forward, and 4 ft. 6 in. aft. The *Princess* has a full female figure head, false quarter galleries, common bow, square stern, and is clinker-built; standing boltsprit; one mast, sloop-rigged; main and break deck. Commanded by Mr. John Livingston, who piloted the royal yacht *Fairy* from the tail of the Bank, Greenock, to Dumbarton and back, on her Majesty's first visit to Scotland, in 1847. Port of Cork.

Eagle.—1 common flue boiler, with six furnaces; frames, $2\frac{1}{2} \times 2\frac{3}{4} \times \frac{3}{8}$, and 1 ft. 11 in. apart. The *Eagle* has a scroll figure head, sham quarter galleries, standing boltsprit; one mast, sloop-rigged; common bow; and is a square-sterned and clinker-built vessel. Port of Cork.

"ROYAL ALICE."

Built and fitted with engines by Messrs. Tod and M'Gregor, Glasgow.

	Ft.
Length on deck	145·4
Breadth on ditto amidships	18·4
Depth of hold ditto	8·0
Length of break-deck	51·8
Breadth ditto	14·4
Depth ditto	·8
Length of engine space	37·6
Tonnage.	Tons.
Hull	$158\frac{6}{100}$
Break-deck	$6\frac{45}{}$
	$164\frac{51}{100}$
Engine space	$59\frac{89}{100}$
Register	$104\frac{62}{100}$

One steeple engine of 96 horses nominal power. Diameter of cylinder, $53\frac{3}{8}$ ins. × 4 ft. stroke. Dia. paddle wheels, extreme, 17 ft. 9 in.; ditto, effective, 17 ft. 2 in. Floats, 6 ft. 3 in. × 1 ft. 4 in. Two sets of 9 arms and 18 floats. Frames, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$, and 2 ft. apart.

One tubular boiler—length, 11 ft. 6 in.; breadth, 15 ft.; height, 6 ft. Five furnaces, 174 tubes, 3 ins. dia. Consumption of fuel per day of 14 hours, $5\frac{1}{2}$ tons, the engine making 32 to 35 revolutions per minute.

The *Royal Alice* has one mast, sloop-rigged; no figure-head; no galleries and no boltsprit; a common bow; and is a square-sterned and clinker-built vessel. Commander, Mr. Archibald Cameron, late of the *Prince*. Port of Cork.

THE IRON SCREW YACHT, "HUMMING BIRD," LATE "FIRE QUEEN."

The property of Thomas Ashton Smith, Esq., of Carnarvon. Built and fitted with engines by Mr. R. Napier, Glasgow.

		Ft.
Length on deck		132·4
Breadth on ditto amidships		18·0
Depth of hold ditto		9·2
Length of engine space		38·2
Tonnage.		Tons.
Hull		$136\frac{64}{100}$
Shaft space	$2\frac{34}{100}$	$70\frac{74}{100}$
Engine space ...	$68\frac{40}{100}$	
Register		$65\frac{80}{100}$

A pair of beam engines, similar to a land engine, of 80-horse nominal power. Cylinders 36 ins. dia. × 3 ft. stroke. Three-bladed screw of brass, 5 ft. 3 in. dia. Spur wheel, 8 ft. $7\frac{1}{2}$ in. dia., with 90 teeth. Pinion 2 ft. 1 in. dia; 22 teeth, pitch $3\frac{5}{8}$ in.

Two tubular boilers, 30 tubes in each, 6 in. dia. × 7 ft. 7 in. long. Three furnaces in each, 8 ft. long, 1 ft. $7\frac{1}{2}$ in. broad. Steam pressure, 17 lbs. This vessel, the first propelled by the screw, made by Mr. Napier, was launched 7th July, 1845, and made her trial trip on 12th August. Her speed at that time, with Smith's patent two-bladed screw, was 13 miles per hour, making $56\frac{1}{4}$ revolutions per minute. In August, 1848, with Mr. Napier's three-bladed screw, her speed was increased to 15 miles per hour, at $46\frac{1}{2}$ revolutions per minute, the draught of water being 7 ft. forward, and 7 ft. 6 in. aft. In 1848, this vessel was put upon the station between Glasgow, Greenock, Ardrossan, and Ayr, by Mr. Napier, to run in opposition to the Ayrshire railway. With this view, two holds were made for carrying goods, and a saloon was constructed on deck, 40 feet long, 8 ft. 6 in. broad, and 6 ft. 1 in. high, similar to the North American mail steamers. On the top of the saloon, aft, was placed the steering-wheel.

The *Fire Queen* had a bust female figure head; no galleries; a clipper bow; a standing boltsprit; two masts, schooner-rigged; one flush deck, and is a square-sterned and clinker-built vessel.

About two months since, this vessel underwent extensive alterations, previous to her again reverting to her former owner. The saloon has been taken off, and a quarter-deck substituted, and the cabin has been fitted with a due regard to elegance and comfort. She has now three masts, latteen-rigged, and may be pronounced the perfection of a yacht, combining the neatness of a sailing-vessel with the safety and sure expedition of a steamer.

"THE DUCHESS OF ARGYLL."

Built by Messrs. Denny, Brothers, Dumbarton. Engines by Messrs. Penn and Son, Greenwich. Boilers by Mr. R. Napier, Glasgow.

	Ft.
Length on deck	146 9
Breadth on ditto amidships	14·6
Depth of hold ditto	6·6
Length of engine space	41·4
Tonnage.	Tons.
Hull	$93\frac{35}{100}$
Engine space	$43\frac{17}{100}$
Register	$50\frac{18}{100}$

A pair of oscillating engines of 70-horses power. Cylinders, 34 in. diam. × 3 ft. stroke. Feathering paddle wheels, 14 feet diam. Floats, 5 ft. 6 in. × 2 ft. Two sets of 12 arms and floats. Two tubular boilers, placed fore and aft. Two furnaces, and 110 tubes in each. Steam pres-

sure, 15 lbs. The engines make 36 revolutions per minute on an average, and the speed of the vessel is 15 miles per hour. Six strakes of plates from keel to gunwale; frames, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$ in. The *Duchess of Argyll* is one of our fastest steamers, and is fitted like most of them, with a steering wheel amidships, on a platform 7 feet high. This plan was introduced on the Clyde by Mr. W. Denny, in 1846, on board the *Loch Lomond*, and is considered far superior to the old plan, as giving the pilot a perfect command over the vessel.

The *Duchess of Argyll* has one flush deck, scroll or shield figure head, and is a square-sterned and clinker-built vessel of iron. Port of Glasgow. Commander, Mr. John Campbell, late of the *Fire Queen*.

THE IRON STEAM YACHT, "JENNY LIND."

Built by Messrs. Denny, Brothers, Dumbarton, and fitted with engines by Messrs. Penn and Son, Greenwich.

Builders' measurement.	As originally built.	After being lengthened.
	Ft. In.	Ft. In.
Length of keel and fore-rake ...	133 0	144 0
Breadth of beam	15 0	15 0
Depth of hold	7 8	7 9
Length of engine room	—	41 5
Tonnage.	Tons.	Tons.
Hull	$158\frac{44}{94}$	$163\frac{68}{94}$
Engine room	—	$50\frac{69}{94}$
Register		$112\frac{93}{94}$
New measurement.	Ft.	Ft.
Length on deck	133·5	144·9
Breadth on ditto amidships ...	14·5	14·5
Depth of hold ditto	7·5	7·65
Length of engine room	—	41·4
Tonnage.	Tons.	Tons.
Hull	$92\frac{77}{100}$	$106\frac{55}{100}$
Engine room	$38\frac{46}{100}$	$49\frac{37}{100}$
Register	$54\frac{31}{100}$	$57\frac{18}{100}$

A pair of oscillating engines of 70 horses nominal power. Cylinders, 34 in. dia. × 3 ft. stroke. Revolutions per minute, 36 average. Feathering paddle wheels, 14 feet diameter. Floats, 5 ft. 6 in. × 2 ft. Two sets of 12 arms and floats. $3\frac{1}{2}$ floats in water, at a draught of 5 ft. even keel.

Two tubular boilers (originally) with two furnaces, and 146 tubes in each, placed abaft the engines. After being lengthened, two tubular boilers by Mr. R. Napier were fitted, fore and aft, both being fired from the engine room. Two furnaces, and 110 tubes in each boiler. Tubes, 3 ins. dia., × 6 ft. long. Furnaces, 6 feet long × 2 ft. 3 in. broad × 3 ft. 10 in. deep.

The *Jenny Lind* has one flush deck, three masts, latteen-rigged, no boltsprit, a common bow, no figure head nor galleries, and is a square-sterned and clinker-built vessel. Port of Carnarvon.

THE BRITISH AND NORTH AMERICAN ROYAL MAIL STEAM NAVIGATION COMPANY'S TENDER, "SATELLITE."

Built and fitted by Mr. R. Napier, Glasgow.

	Ft.
Length on deck	108.5
Breadth on do. amidships	18.8
Depth of hold do.	9.7
Length of engine space...	37.8
Tonnage.	Tons.
Hull	$156\frac{71}{100}$
Engine room	$74\frac{60}{100}$
Register	$82\frac{11}{100}$

One side lever-engine of 80 horse nominal power. Cylinders 50 in. dia. × 3 ft. 6 in. stroke. Paddle wheels, dia. extreme, 13 ft. $6\frac{1}{2}$ in.; ditto effective, 13 ft. $\frac{1}{2}$ in. Floats, 6 ft. 10 in. × 1 ft. $7\frac{1}{2}$ in. Two sets of 12 arms and floats. One common flue boiler, with 4 furnaces. Frames, $3 \times 2\frac{1}{4} \times \frac{1}{2}$ and 2 ft. $8\frac{1}{2}$ in. apart.

The *Satellite* has two masts, schooner rigged; no boltsprit, figure head, nor galleries; one flush deck, and is a round sterned and clinker-built vessel of iron. Launched, 1848.

THE "UNICORN."

Built by Messrs. R. Steele and Co. The engines by Messrs. Caird and Co. Greenock.

Builder's Measurement.	Ft. In.
Length aloft...	166 0
Do. keel and fore rake...	165 0
Do. engine space	61 1
Breadth of beam	25 2
Do. over paddle boxes	45 2
Depth of hold	17 8
Tonnage.	Tons.
Hull	$504\frac{93}{94}$
Engine space	$205\frac{73}{94}$
Register	$299\frac{20}{94}$
New Measurement.	Ft.
Length on deck	162.9
Breadth on do. amidships	23.5
Depth of hold do.	17.3
Length of quarter deck	55.8
Breadth of do.	27.75
Depth of do....	3.5
Length of engine space	61.1
Tonnage	Tons.
Hull	$589\frac{2600}{3500}$
Quarter deck	$58\frac{2284}{3500}$
Total	$648\frac{1384}{3500}$
Engine space	$258\frac{1877}{3500}$
Register	$389\frac{3004}{3500}$

Two side lever engines, with cast iron framing, of 274 horse nominal power. Cylinders, 60 in. dia. × 5 ft. 9 in. stroke. Paddle wheels, dia. extreme, 23 ft. $4\frac{1}{2}$ in.; do. effective, 22 ft. $10\frac{1}{2}$. Floats, 8 ft. 5 in. × 2ft. 1 in. Three sets of 21 arms and floats.

Two tubular boilers were put in, in 1848: length, 10 ft.; breadth, 10 ft. 6 in.; height, 14 ft. 224 brass tubes, $3\frac{1}{4}$ in. internal dia., and three furnaces in each, 7 ft. long, 2 ft. 10 in. broad, and 3 ft. 3 in. deep. The former boilers were flue boilers, with return elliptical flues over the ordinary flues. (For dimensions and details see *Artizan* "*Treatise on the Steam Engine*," p. 59.)

This vessel was launched in May, 1836, and belonged to the Glasgow and Liverpool Steam Shipping Company. During the first year of her plying on this station, she was commanded by Mr. Hugh Main, who kept a log of her trips, which, during that period, averaged $11\frac{631}{861}$ miles per hour. In 1840, she was put upon the station between Halifax, N. S., and Quebec, in conjunction with the other steamers of the British and North American Royal Mail Company. Afterwards she was employed on the station between Halifax, N. S., and St. John's, Newfoundland. Three screw steamers were lately put on that station, viz., the *Osprey*, *Falcon*, and *Kestrel*; and the *Unicorn* was withdrawn, sold to the Americans, and has been since sent to California.

The *Unicorn* had a quadruped figure head, ("Unicorn.") false quarter galleries, three masts, schooner rigged, and a standing boltsprit, and was a square sterned and carvel-built vessel of timber. She was one of the Glasgow and Liverpool Steam Navigation Company's line, which comprised the following:—*Ailsa Craig*, 1825—*Glasgow*, 1829—*Liverpool*, 1830—*Clyde*, 1831—*Manchester*, 1832—*Eagle*, 1835—*Unicorn*, 1836—*Actæon*, 1837—*Achilles*, 1839—*Orion*, 1847. These vessels ran in competition with the City of Glasgow Steam Navigation Company's line, consisting of the following vessels:—*City of Glasgow*, 1822—*Solway*, 1826—*John Wood*, 1831—*Vulcan*, 1833—*City of Glasgow*, 1836—*Commodore*, 1838—and *Admiral*, 1840.

ROYAL STEAM NAVY.

APPOINTMENTS, &c.

Chief Engineers.—John Chester, to the *Phœnix*. B. Hoare, to the *Vesuvius*.

First Class Assistant Engineers.—W. Anderson, to the *Fisgard*. F. Akers, to the *Vesuvius*.

Second Class Assistant Engineers.—James Downie, to the *Hogue.* H. Bydder, to the *Vesuvius.*

Third Class Assistant Engineers.—Charles Bydder, to the *Hogue.* J. R. Johnson, to the *Vesuvius.*

John Thomas, leading stoker of the *Blazer*, recently paid off, has received a gratuity of £15, and a medal for good conduct.

DOCK-YARD INTELLIGENCE.

Woolwich.—*Minx*, iron steam-vessel, is ordered to be fitted with a screw-propeller abaft the rudder, according to a plan proposed by Messrs. Seaward & Co., by way of experimental trial.

Portsmouth.—Trial of the "Ajax."—This screw line-of-battle-ship, 60 guns, 1,761 tons, 450 horse-power, was taken out of harbour on 6th inst., by Captain Horatio Austin, C.B., and the officers of the steam ordinary, to make a final trial of her capabilities before commission. She had all her weights aboard and lower masts in.

RESULT OF THE TRIALS AT THE MEASURED MILE IN STOKE'S BAY.

No. of trials.	Time occupied in running the mile.	Speed in knots.	Mean speed.	Reduced mean.	No. of strokes per minute.
	min. sec.				
First.....	8 2	7.468	6.8695	7.124	46 (*a*)
Second...	9 34	6.271	7.38		48 (*b*)
Third....	7 4	8.49	6.88	7.13	48 (*c*)
Fourth...	11 23	5.27			48 (*d*)
				14.254	

Mean speed (knots per hour) 7.127

	Ft.	In.
Draught of water—forward	21	11½
" " aft	23	1½
Height of the lower deck midship portsill from the water	5	5½

Remarks:— (*a*) The tide was in favour.
(*b*) The tide and wind were a-head.
(*c*) The tide and wind were in favour.
(*d*) The tide and wind were a-head.

The engines are horizontal, by Messrs. Maudslay. Four cylinders 55 inches diameter, and 2 feet 6 inches stroke. Smith's screw, 16 feet diameter, and 20 feet pitch. The boilers are said to prime very much, owing to the want of steam room.

It has been for some time rumoured that Captain Henderson, C.B., will ultimately commission her, and it is conceded pretty generally that a better man could not be intrusted with so responsible a command.

Malta.—The new dry dock, built on purpose to receive the "largest vessel" in the British Navy, is found too small to admit the *Terrible;* at least there are about three inches to spare between her paddle-boxes and the dock wall of the gates, provided she unships her floats.

Progress of the Keyham Works.—Keyham works are bounded on the west by Hamoaze, on the south by Moon's Cove, on the east by the turnpike-road leading from Devonport to Saltash, and on the north by the old Keyham powder works. The river (Hamoaze) wall is completed, from south to north, as far as the coffer-dam will allow; and the Moon's Cove wall, facing Morice-town, is finished from the west to the east, near the eastern or main entrance in the turnpike-road. The south basin is nearly completed, with the exception of the east wall, and the entrances to the docks. The north dock is progressing with expedition. The entrance between the basins is nearly finished, as is the entrance from the north basin to the river. The west and south walls of the north basin are complete, and nearly all the excavation has been removed. The entrance lock is nearly completed. The engine-house for pumping the docks is finished; the machinery and boilers have arrived, and will be fixed immediately. The factory buildings and officers' houses have not been commenced; it is expected that the foundations will be laid shortly after April, 1850. There are 800 artificers and labourers now employed by the contractors, Messrs. Baker and Son. The expenditure on these works formerly was £10,000 per month; it is now reduced to about £5,500.

Steam Engines of the Royal Navy.—The following table has been compiled from the list of the steamers in the navy, given in Messrs. Main and Brown's work on the marine engine, and will, no doubt, be interesting to our readers:—

Name of Firm.		P. Wheel.		Screw.		Total H. P.
Seaward and Co. ...	H. P.	5790	H. P.	1920	...	7710
Maudslay and Co.	...	5520	...	1510	...	7030
Boulton and Watt	...	3365	...	...	...	3365
Miller and Ravenhill	...	1531	...	1222	...	2753
Penn and Co. ...	...	1890	...	748	...	2638
Messrs. Rennie ...	...	2017	...	150	...	2167
R. Napier ...	...	1475	...	580	...	2055
Fairbairn ...	...	1890	...	...	...	1890
Fawcett	...	1824	...	...	...	1824
Forrester	...	910	...	...	...	910
Scott and Sinclair	...	760	...	...	...	760
Rigby	...	515	...	...	...	515
Butterly Co. ...	...	280	...	...	...	280
Caird and Co. ...	...	240	...	...	...	240
Coates	...	144	...	...	...	144
						34281

The value of this machinery at £50 per H. P. would be £1,714,050

Self-heating Shot for War Purposes.—We saw the other day, in the establishment of Mr. Field, tin-plate worker, Argyll-street, a peculiar and apparently most valuable mode of obtaining red-hot shot for great guns. It is the invention of Mr. Scouller, the foreman in Mr. Field's workshop, and consists in the filling the hollow shot with a highly combustible powder, the composition of which we are not yet at liberty to make public. Two or three fuse-holes are made in the shot, so that when fired from the piece, ignition takes place, and the shot is made red-hot before it arrives at its destination. In the trial we saw, the shot, which was about two inches and a half in diameter, was simply laid on the ground and the composition was ignited by a light applied to the fuse-hole. Violent combustion immediately ensued—liquid fire appeared to stream from its three fuse-holes, and the metal became quite red-hot in a few seconds. The inventor states, that when fired from a gun a red heat will be attained in less than 20 seconds from its leaving its mouth. The composition will burn under water. It is easily made, and there is little doubt as to its efficiency for war purposes in place of the present expensive and troublesome system of heating, the shot being put into a gun in a cold state as with ordinary solid balls.—*Glasgow Chronicle.*

New Gun Carriage.—A gun carriage has just been invented by a naval officer, Mr. H. D. P. Cunningham, which proposes to economise much time and labour on board ship. The principle of this plan is, that the force which drives the gun back in the recoil is collected and applied to run the gun out again. The gun is thus in fact made to work itself, a few hands being required only for the loading and training. The carriage is placed on a slide on which it works; in this slide there is a tube having a piston and piston-rod, to the end of which the carriage is attached by a screw collar. This tube is opened at the inner end, and at the other end is furnished with a valve opening or shutting by a handle. The piston being at the bottom of the tube and the valve closed, the gun on being fired, recoils and carries the piston with it; a vacuum is then formed at the outer or valve end of the tube, which creates an amount of atmospheric pressure on the inner side of the piston, regulated by its diameter, equal to the force of recoil, which pressure will of course drive the gun out again. In order to detain the gun during the operation of loading, there is a lever attached to the inner part of the carriage with a catch which falls on a stop bolt and per-

forms that duty; after loading, by simply lifting the end of the lever, the carriage is released, and is driven out by atmospheric pressure. It is presumed that the shock of the recoil will be so diminished by the elasticity of the air, that the sides of the ship will be relieved of much of the usual strain.

STEAM NAVIGATION & SHIP BUILDING.

Trial of the "Bosphorus."—The trial of this ship, belonging to the General Screw Steam Shipping Company, took place on the 13th ult. The following gentlemen were on board to witness the experiments:—Captain W. Houlston Stewart, R.N.; Captain Halstead, R.N.; Mr. Chatfield, Assistant Master Shipwright, Woolwich; Mr. Humphreys, Chief Engineer, Woolwich; Mr. Dinnen, Inspector of Machinery Afloat; Mr. Smith, Chief of the Screw Department; Messrs Maudslay and Mr. Jackson; Mr. Mare, the builder; Mr. Laming, Managing Director; Captain Ford, Superintendent. The dimensions of the ship are:—Length, 175 feet; breadth, 25 feet; measurement in tons, 531; horse-power, 80; diameter of cylinder, 36 inches; stroke, 24 inches; diameter of screw, 10 feet 6 inches; pitch, 18 feet 6 inches; mean revolutions, 62.2; length of engine-room, 30 feet, which includes a space for the stowage of 150 tons of coals; draught of water on trial—forward, 6 feet 8 inches; aft. 9 feet 6 inches, the screw propeller being 14 inches out of water. The trials at the measured knot were:—

	Time.	Knots.
1st knot	5 min. 10 sec.	10·286
2nd ,, ...	6 min. 21 sec.	9·418
3rd ,, ...	6 min. 4 sec.	9·890
4th ,, ...	6 min. 9 sec.	9·756
5th ,, ...	6 min. 54 sec.	8·695

giving a mean speed of slip in knots 9·679; speed of screw, 11.348; slip in knots, 1·669, or 14·7 per cent. The *Bosphorus* left Blackwall about 1h. p.m., and proceeded down the river, the wind at the time blowing hard from the S.W.

The "Scharkie."—The *Scharkie*, Egyptian steam-frigate, left Falmouth on the 21st July and arrived in the Tagus on the 24th, making a splendid run, chiefly under steam, from port to port of 61 hours, the wind being nearly the whole time fresh against her.

Loss of a Steamer.—The steamer *Lubeck*, on the night of the 22nd, came into collision with the iron steamer *Frederick Frantz II.*, when, within half an hour, the latter sank. The crew and passengers, with the exception of two, were saved by the *Lubeck*.

Fatal Accident on board the "Kent."—The stoker on board the *Kent*, one of the steam ferry boats between North and South Woolwich, has been killed by getting entangled in the engines.

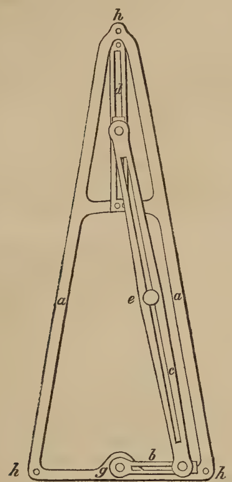
Galway a Packet Station.—The *Dublin Evening Packet* announces that "the establishment of Galway as a Transatlantic packet station is almost an accomplished fact." It is stated that three steamers, of 1,500 tons each, are building at Liverpool to ply between Galway and Halifax. It is proposed that they shall carry the mail, and that the average length of the voyage shall not exceed six days. It is also proposed to send the West India mail *viâ* Halifax, at which port the West India steamers are to meet the Galway packets, thus establishing a direct communication between Ireland and the West Indies. This has been since contradicted, though there are grounds for believing that it is only a question of time.

Lighthouse for Cape Pine, Newfoundland.—The lantern and lighting apparatus, which have been furnished for the above structure by Messrs. Deville and Co., from plans by Mr. Alexander Gordon, C.E., are at present on private view at their establishment, 367, Strand. The light is a revolving one, and an intense and peculiar illumination is produced at short intervals by means of sixteen reflectors of a novel form. These reflectors are bell-shaped, and the light which they exhibit will be easily distinguishable from that of any lighthouse on the same seaboard. In consequence of the great and sudden changes of temperature in the region for which it is destined, the lantern is fitted with a double envelope of glass. Late in April, in this year, Mr. Gordon was directed by government to construct a lighthouse for erection at Cape Pine. The situation is very difficult of access, the site being 246 feet above the level of the sea; and, with the exception of some wreckers, who live three miles off, it is uninhabited. A bare rock supplies the place of road or harbour, and on this Mr. Gordon's agents will have to erect a crane as a *point d'appui*, and thence to the top of the cliff, a flying wire-rope bridge, 500 feet long. These appliances, and the cast iron tower of the lighthouse, were made by Messrs. C. Robinson and Son, of Pimlico, and were shipped for Newfoundland on the 14th inst., within 80 days from the date of the order. The tower contains several rooms for the light keepers, and is furnished with cooking and warming apparatus. It resembles the other cast iron lighthouse towers which Mr. Gordon has made and erected at Jamaica, Bermuda, Ceylon, &c. In the year 1845, Mr. Gordon proposed to the lighthouse committee of the House of Commons that, instead of bells, guns, or gongs for fog-signals, a screaming apparatus, with revolving or horizontal reflectors of the sound should be used, and he expects that his invention will, by order of the government, be supplied to this new lighthouse at Cape Pine, where, in consequence of the dense fogs which are prevalent, far-reaching sound is little less important than brilliant light.

The "Britannia" Steamer making her Way through the Ice in Boston Harbour.—Looking into the windows of a print-shop, I saw an engraving of our good ship, the *Britannia*, which we had just quitted, represented as in the act of forcing her way through the ice of Boston harbour, in the winter of 1844—a truly arctic scene. A fellow-passenger, a merchant from New York, where they are jealous of the monopoly hitherto enjoyed by their New England rival, of a direct and regular steam communication with Europe, remarked to me that if the people of Boston had been wise, they never would have encouraged the publication of this print, as it was a clear proof that the British government should rather have selected New York, where the sea never freezes, as the fittest port for the mail packets. I had heard much during the voyage of this strange adventure of the *Britannia* in the ice. Last winter, it appears, there had been a frost of unusual intensity, such as had not been known for more than half a century, which caused the sea to be frozen over in the harbour of Boston, although the water is as salt here as in mid-ocean. Moreover, the tide runs here at the rate of four or five miles an hour, rising twelve feet, and causing the whole body of ice to be uplifted and let down again to that amount twice every twenty-four hours. Notwithstanding this movement, the surface remained even and unbroken, except along the shore, where it cracked. Had the continuance of the frost been anticipated, it would have been easy to keep open a passage; but on the 1st of February, when the *Britannia* was appointed to sail, it was found that the ice was seven feet thick in the wharf, and two feet thick for a distance of seven miles out, so that waggons and carts were conveying cotton and other freights from the shore to the edge of the ice, where ships were taking in their cargoes. No sooner was it understood that the mail was imprisoned, than the public spirit of the whole city was roused, and a large sum of money instantly subscribed for cutting a canal, seven miles long and 100 feet wide, through the ice. They began the operation by making two straight furrows, seven inches deep, with an ice plough drawn by horses, and then sawed the ice into square sheets, each 100 feet in diameter. When these were detached, they were made to slide, by means of iron hooks and ropes fixed to them, under the great body of the ice, one edge being first depressed, and the ropes being pulled by a team of horses, and occasionally by a body of fifty men. On the 3rd of February, only two days after her time, the steamer sailed out, breaking through a newly-formed sheet of ice, two inches thick, her bows being fortified with iron to protect her copper sheeting. She burst through the ice at the rate of seven miles an hour without much damage to her paddles; but, before she was in clear water, all her guard of iron had been torn off. An eye-witness of the scene told me that tents had been pitched on the ice, then covered by a slight fall of snow, and a concourse of people followed and cheered for the first mile, some in sleighs, others in sailing-boats fitted up with long blades of iron, like skates, by means of which they are urged rapidly along by their sails, not only before the wind, but even with a side wind, tacking and beating to windward as if they were in the

water. The *Britannia*, released from her bonds, reached Liverpool in fifteen days, so that no harm had been occasioned by the delay; and when the British Post-office offered to defray the expense of the ice-channel, the citizens of Boston declined to be re-imbursed.—*Lyell's Second Visit to the United States of North America.*

AN IMPROVED ELLIPTOGRAPH.



The engraving represents a plan of the instrument about quarter size. *a, a,* is a frame of brass or wood; *c* is a connecting-rod, the upper end of which works on a pin sliding in the slot *d*, and the other end on a pin moveable in the slot *b* in the crank *g*. *e* is a pencil-holder, sliding in the slot in the connecting-rod, with a nut to fix it in any required position.

To use the instrument, you regulate the greater diameter by shifting the pin in the crank *g*, which is marked with a scale. The lesser diameter is regulated by shifting the pencil in the connecting-rod. The instrument is kept off the paper by three points at *h, h, h.* When it is to be used, the crank is turned by a thumb-screw on the upper side of the bearing, and a perfect ellipse will be described by the pencil. In order to keep the pencil pressing equally on the paper, it is proposed to mount it in a telescopic tube, with a small spiral spring inside, which will exert a gentle pressure on the paper.

Gateshead Fell. J. S.

SHIP CANAL BETWEEN THE ST. LAWRENCE AND LAKE CHAMPLAIN.

The project of a ship canal to connect the St. Lawrence river with Lake Champlain, which has been long in agitation, has at length received so much of form and substance that the parliament of Canada have granted an Act of Incorporation for such a work. The charter, as we learn from the *Saratoga Republican*, is of the most liberal character, leaving the whole contract and the selection of the route and of the work itself to the stockholders, whether residents of the province or of the state. The Saratoga paper adds:—

"One route, commencing at Caughnawaga, at the head of the Lachine Rapids, nine miles above Montreal (to which point there is a ship canal from Montreal), and terminating at St. John's, was surveyed two years since by order of the Government. The distance is but nineteen miles, over a very flat country, and shows only a fall of sixteen feet between Lake Champlain and the St. Lawrence. The entire route is so feasible, and the advantages are so great, that the only wonder is, that the work has not been completed years ago. That it will be finished now at an early dae there can be no doubt; and that it is designed to produce one of thy greatest revolutions of modern times in trade is equally certain. When completed, steamers from all the western lakes can reach Whitehall without breaking bulk. The time employed in the transmission of produce and goods between the Great West and New York will be lessened from eight to ten days, and in many cases more; the expenses will be materially reduced; the navigation will commence much earlier than on our state canals. Whitehall will ultimately possess the importance of Buffalo; and the Great North, with its tide of travel and business, will become as proverbial as the Great West is at the present time."

The effect of such a canal as this cannot be overrated, nor measured as yet. One of its tendencies will be to make New York the seaport of Montreal and of Canada West, instead of Quebec. Another will be to bring the far western produce and travel, without breaking bulk, to Whitehall, whence a continuous railroad now is, or soon will be, in operation to the city of New York, besides the Northern Canal, for the transportation of heavy produce. Such a canal is the fitting complement of the Welland Canal, which for commercial purposes annihilates the Falls of Niagara, as this will the strip of land which divides the waters of the St. Lawrence from those of the Hudson. New York city has as deep an interest, as it seems to us, in the construction of such a canal as Montreal itself; and if, in the progress of events, the Canadas shall become hereafter part and parcel of these United States, this canal will be a link ready formed to bind the new to the old States, and make us one in interest as in feeling.—*New York Paper.*

From the *Pittsburg Journal* April 2, 1849.

REPORT OF THE EXPLOSION OF A STEAM BOILER IN ALLEGHENY CITY, PENNSYLVANIA.

PITTSBURG, *March* 29, 1849.

THOMAS BAKEWELL, Esq., President of the Board of Trade.

DEAR SIR:—The Committee appointed by you on the 27th instant, to enquire into the cause or causes which led to the late fatal explosion of a steam boiler in Allegheny City, would ask leave to submit the following

REPORT.

That they have visited the premises, and made their own observations but not having authority to take depositions under oath, they have made inquiries of those whom they could find, who would be most likely to know the facts in the case. Among these were Mr. Andrew Fife, one of the owners, and who was running the engine at the time of the explosion; Mr. David Fife, who we believe, was also one of the owners, and in the factory at the time; and J. Rush, Esq., Mayor of Allegheny, who occupied the adjoining building with woollen machinery, and his son, who was in the building at the time, and several others who were early on the ground or had good opportunities of knowing some of the particulars. And from all the information which your Committee have been able to collect, they believe the facts in the case are as follows, viz.:

The boiler which exploded was thirty-six inches in diameter, and eighteen and a half feet long, without flues. The shell, or cylindrical part, was made of three-sixteenths iron, and the heads of cast iron, one and an eighth and one and three-sixteenths of an inch thick; the supply in the back end, near the bottom; the steam pipe and safety valve on the top, near the front; the man plate in the front, near the front; and three gauge cocks in the front, the lower one of which was at the centre of the boiler, or in a horizontal line across the centre—the other two above it. The boiler supplied an engine, the cylinder of which is six inches bore and thirty inches stroke, which propelled cotton machinery in the building in which it stood, belonging to the Messrs. Fife, and woollen machinery in the adjoining building, belonging to J. Rush, Esq.

The engineer says that the explosion occurred about 11 o'clock, A.M.; that the engine was running as usual; that he had just tried the middle

cock, and found water as usual; and had just turned to go out of the door, for coal, when he felt himself forced forward, and the house falling down about him.

It appears that the back head of the boiler was forced out, all at once, leaving the flanch or rim of the head, rivetted to the end of the boiler, as it was; the head went directly back some thirty feet, carrying with it the entire bottom of the brick chimney, (which stood directly back of the boiler), causing the whole of the chimney to come down, and perhaps topple forward upon the top of the house, which came down at the same time, but partly owing, perhaps, to the back wall of the house being forced out by the lateral pressure of the steam which issued from the back end of the boiler as it passed forward; the boiler having been in the lower story of the house, parallel with and against the back wall. When the back head of the boiler gave way, the back end being entirely relieved, while the pressure continued against the front head as usual, the boiler was of course carried forward, passing through the two end walls (which were of stone) of the adjoining woollen factory, and raking the back wall of the same, tearing it down its whole length, (about twenty feet), and landed in the next yard, where it now lies. Had not the front head been demolished, by battering down the stone walls, it would have continued its course on through a frame house, and gone out into the East Common. But as soon as the front head was destroyed, the weight of steam within it was soon neutralized, and the boiler continued only by the momentum which it had received, in the short time which elapsed between the giving out of the back head and the battering in of the front head, the front stone wall having been only five feet from the front of the boiler.

The boiler in question was made some nine months ago, with wrought iron heads and two flues, as is usual with river boilers, and put with another on a small steam boat, where it exploded about three months afterwards. It was then taken ashore, the flues and heads taken out, two new cast iron heads and two new rings of boiler iron put in, and then put up as before described. No effect, however, of the former explosion remained with the boiler, nor has any part given way which was then in the boiler; the whole boiler, indeed, is of good material and workmanship, and had no fault except that of being *too light*, especially in the heads, for the enormous weight which was crowded upon it.

Two of the most important facts in the case of this explosion your Committee have not been able to ascertain with certainty; that is, the amount of weight on the safety valve, and the supply of water in the boiler; the very explosion itself almost necessarily destroying all evidence in the case, leaving us, as usual in such cases, to conjecture upon such circumstantial evidence as might be found.

The engineer doubtless thought there was water at the second cock, as he had just tried it; but far more experienced engineers have been deceived by a *show* of water at first, where repeated trials, or holding the gauge open for some time, may show only blue steam.

The boiler has the appearance of having been highly heated, but whether it was before or after it was moved out of its place, your Committee are somewhat divided in opinion. It is not necessary, however, in accounting for the explosion in this case, to suppose a scarcity of water, as there is sufficient cause without.

It appears that machinery had been added on, in various parts of the establishments, until the engine was fairly overloaded, and a gradual increase of steam raised until the back head yielded, which was of itself sufficient to produce the result as we found it, without supposing the existence of any combustible or explosive gas, which may or may not occur in similar cases, but which, we think, did not in this.

As to the amount of weight on the safety valve, the Committee are quite uncertain. The persons who put up and attended the engine, said they were carrying about sixty pounds to the inch, but perhaps, like most persons in that employment, had never made an accurate calculation, to be certain whether it was so or not.

We found two safety weights lying together with the safety valve, lever chamber, and fixtures, but neither of them on the lever, but both of them *had* been on when the engine was in use in another place; and your Committee are strongly inclined to the belief, from all the testimony and circumstances in the case, that they were both on at the time of the explosion, although this is not admitted by some who ought to know. One of these weights was $38\frac{1}{4}$ lbs.; and the other $21\frac{1}{2}$ lbs.; the safety valve is two inches diameter *scant*, or about three square inches area; the last notch in the lever is ten times the distance of the fulcrum; the lever we did not weigh in position, but suppose it would require thirty pounds to raise it. The engineer said he had the small weight in the last notch; but finally admitted he had a large boiler wrench which, he supposed weighed about ten pounds, hung on at the same place. This would require the pressure of steam inside to be 116 lbs. per square inch over the pressure of the atmosphere, before the valve would raise, even taking his own statement of the facts. But if we had the other weight, which was found with the rest, and which some say that they have seen on lately, and allowing that to hang at the middle of the lever, it would add 64 lbs. per inch, or 180 lbs. per inch in all; or if it hung in the notch next the small weight and wrench, it would have made the whole weight 230 lbs. per inch. But take the engineer's statement, which gives 116 lbs. pressure per inch, we would consider it rather unsafe for many of our land boilers in use about the cities, and entirely unsafe for this one, without *double* that pressure, which was probably the fact.

It is a custom (much to be regretted) among beginners, manufacturing on a small scale about our cities, to commence with cheap and light boilers and machinery, and inexperienced engineers, seeming to think that such temporary arrangements may do for so small a business, and that when they have become able to extend, they will make things more permanent and secure.

Alas! many of them never see that day from this very cause. The last three explosions which we have had were all of this kind; and in each of two of the cases, one of the owners, one of the families, and several in employ, were killed. We would also remind our numerous manufacturers who are doing business on a more extensive scale, that all the explosions which have occurred about our cities have been similar to this; that is, the cast iron head has been torn from the rim, the crack commencing in the inner angle; being occasioned first by inclining to draw off from the rim in cooling, when cast, and continued by springing the centre of the head out by the pressure of steam, and relaxing when steam was down, which daily vibrations, in course of time, deepen the fracture and weaken the head.

All boiler heads made here in former years, were too light for the pressure of steam now generally used; many of them have been replaced, and many more, no doubt ought to be, with new and strong ones.

Our government now requires boiler heads, even for thirty-inch boilers, to be one and a half inches thick.

Your Committee would also even caution our fellow-craft not to furnish boilers of a light or temporary kind, although the owners may volunteer to assume all responsibility.

In conclusion, your Committee would further recommend to the Board of Trade to use their influence at the proper time, with the proper authorities, to have such laws or jurisdiction extended over all land engines, as now applies to our marine engines.

Respectfully,

W. J. Totten,
Wm. P. Eichbaum,
Wm. McClelland,
Wm. Barnhill,
} *Committee.*

ANALYSIS OF PATENTS.

William Brown Roof, of Stanhope-street, Regent's Park, chemist, *for certain improvement in the construction of respirators.* Patent dated September 21, 1848.

The patentee proposes to construct respirators, with such a combination of valves and tubes, that the air expelled from the lungs shall not mix with the air entering the lungs, but shall pass off by separate apertures, warming in its progress the entering air.

Charles Rowley, of Birmingham, in the county of Warwick, button manufacturer, *for improvements in the manufacture of buttons*. Patent dated August 28, 1848.

THE first part of this invention consists of a machine for making "sewn-through" metal buttons, in which the operations of cutting off, punching, countersinking, and punching the holes are performed consecutively, the machine being fed, and the operations continually succeeding each other. The second part consists in making "leek buttons," with a back metal shell and flexible shank. The third consists in grinding facets on buttons of ivory, pearl, &c., to imitate glass. The fourth consists in making sewn-through buttons of horn, &c., with a back metal shell holding a cover of woven material. The fifth, in compressing buttons covered with velvet in dies to impress a pattern thereon. The sixth relates to the construction of the dies. The seventh, in the construction of "sewn-through" buttons, by inserting a piece of wire, which is held by the working down of the front disc, and provides a means of attachment to the cloth. The eighth part consists of an ingenious machine for punching out the discs of cloth to form the button covers. At each stroke of the punch, the cloth is moved so as to make the centres of the discs form an equilateral triangle with each other, by which means a greater quantity can be got out of a given area of cloth than if they were punched in squares.

William Sager, of Rochdale, in the county of Lancaster, wool dealer, *for certain improved means and apparatus for effecting the transit or conveyance of goods, passengers, and correspondence by land or water, and for other such purposes; part or parts of which means or apparatus constitute a new and improved method of generating steam; which improvement is applicable to other purposes to which steam is generally applied as a motive power*. Patent dated September 15, 1848.

THE first part of this invention consists of a steam-generator or boiler. Three tiers of fire-bars are shown, one above the other (we fear the two upper sets would not last long), and having oval tubes lying in the fire, and having an exit-pipe for the steam. Through the middle of each of these runs a feed-pipe, pierced on the under side with holes, through which the feed-water is introduced. Square vessels, with concave bottoms, are put over these elliptical ones, with a space between, through which the heated air circulates. The tops of the vessels are protected by fire-clay. The second part consists of a locomotive for common roads. The main feature appears to consist in a driving-wheel, with bevelled sides, mounted with the crank-shaft and cylinders on a swinging frame, by rotating which the bevelled sides of the wheel may be brought into play, and so the apparatus is turned and steered. A method of propulsion is described by legs worked against the road by the piston-rods. A new form of vessel resembling a barge with a keel of immense size and depth, and a method for employing balloons to hold up the sails on board ship instead of masts, which our readers will no doubt excuse us from diving into.

William Thomas Henley, of Clerkenwell, philosophical instrument maker, and David George Foster, of Clerkenwell, aforesaid, metal merchant, *for certain improvements in telegraphic communication, and in apparatus connected therewith; parts of which improvements may be also applied to the moving of other machines and machinery*. Patent dated August 10, 1848.

THE claims are, first, with respect to telegraphic communications, the peculiar arrangements and combinations described under the first head of the specification, in so far as regards the dividing the poles of the electro-magnet into two or more pairs of poles, and the direct attachment of the magnetic bar, needle, or indicator, to the magnet, placed within the sphere of influence of the poles of the electro-magnet, in the manner described.

Secondly, for the mode of permanently deflecting the needle (for so long as may be desired), and the bringing back such needle to its original position, by the reversed current, and there retaining it by the residual magnetism, both currents being of the same intensity.

Thirdly, the three several arrangements described for producing two currents with the use of one magnet, whereby single or double currents can be sent, as desired, to a distant station.

Fourthly, for the application of the compound of gutta-percha, described, to any machines or machinery, motion to which is, or may be, given by currents of electricity, for the isolation and protection of the conductors.

Fifthly, for the code of visible symbols described for telegraphic communication.

Sixthly, for the peculiar current reverser described, as applicable to currents of electricity derived from a voltaic battery, such reverser completing the circuit twice during each depression, in the manner of the magneto-electric machines.

Seventhly, for the giving motion to time-keepers from two permanent magnets, without the aid of soft iron; also the apparatus and machinery described for obtaining such motion.

Eighthly, for the mode of giving motion to, and regulating machinery by, magneto-electric machines or voltaic batteries, in the manner described and set forth, and for the peculiar combination and arrangement of the parts before described.

John Frearson, of Birmingham, machinist, *for improvements in bending or shaping iron or steel and other metal*. Patent dated September 21, 1848.

THE patentee describes a machine for forming chain links, in which the bars are fed, whilst red hot, into the machine, and there acted upon by punches and dies moved by cams, which cut off the lengths of iron and bend them over a suitable mandril, which is withdrawn when the link is finished. A nail pointing machine is also described, but it would be impossible to go into the details without numerous drawings. The patentee claims, first, the forming of links for iron chains in a state suitable to be welded by another machine, or by hand, by feeding in hot bars from the rolls or from the furnace, and causing lengths to be cut off and bent into shape without the necessity of the piece of iron being moved by hand between the process of cutting and bending. Secondly, the mode of combining the parts for cutting and shaping metal as described, with respect to the cuts shown. Thirdly, the forcing of pieces of iron between one or more pairs of grooved rollers or surfaces, with other apparatus as described. Fourthly, the feeding of lengths of metals into the link-bending machine, by the apparatus termed the hopper. Fifthly, the mode of welding links of chains, as described, by means of tilt-hammers. Sixthly, the mode of shaping two pieces of metal, with points, as described.

George Nasmyth, of 18, Great George-street, Westminster, civil engineer, *for certain improvements in the construction of fireproof flooring and roofing, which improvements are applicable to the construction of viaducts aqueducts, and culverts*. Patent dated September 4, 1848.

THIS invention consists, first, in constructing floors of iron plates bent into a segmental form, and having their ends held by tie rods, the ends of which are to be bent over so as to clip the plates. The ends of these arches rest on girders which have knees on them to prevent the ends rising when the weight comes on; or, instead of using heavy plates, lighter plates may be used, supported on angle or T-iron. To form a floor, the haunches of the arch may be filled up with brickwork and cement, or with earthenware pipes, where great lightness is required. The second part consists of an improved girder, composed of plate and angle iron, the top plate and angle iron being curved, and the ends being held by tension-bars, as before described. The spaces which are necessarily left may be made subservient to the purposes of warming and ventilation.

Fennell Allman, of Charles Street, St. James's Square, Westminster, *for certain improvements in apparatus for the production of light from electricity*. Patent dated December 28, 1848.

THE patentee claims—First, as his invention, and the exclusive use, of a conductor or conductors of voltaic or other electricity, in connection with a permanent magnet or magnets, as an improvement in apparatus for the production of light from electricity.

Secondly, the use of permanent and induced or temporary magnets in conjunction, as an improvement in apparatus for the production of light from electricity.

Thirdly, the employment or use of conductors of voltaic or other currents of electricity, arranged in such a manner that the like poles of such conductors are presented so as to repel each other, as an improvement in apparatus for the production of light from electricity.

Fourthly, the use of conductors of currents of electricity in conjunction with temporary or induced magnets, or of induced magnets alone, as an improvement in apparatus for the production of light from electricity.

Fifthly, he claims as his invention the methods described, or any other means whereby the calorific effects of currents of voltaic or other electricity are made available for the management of the electrodes in apparatus, for the production of light from electricity.

Sixthly, the arrangement described, or any other modification thereof, whereby the decomposing effects of currents of electricity are rendered available for separating, and maintaining the electrodes, or luminous terminals of the current at a limited distance, as an improvement in apparatus for the production of light from electricity; also the use of the voltameter as described.

Seventhly, the apparatus or arrangements described or any modification thereof, whereby the drawing off of the exhausted liquid from a battery, is entirely governed by its gravity or density.

Eighthly, the use of force pumps and other hydraulic machinery or apparatus, in connection with electric batteries for the production of light.

Henry Wilson, foreman to Messrs. Greaves and Son, of the Sheaf Works, Sheffield, *for improvements in the manufacture of chisels and gouges*. Patent dated September 21, 1848.

THIS invention consists in making such tools much stronger, by combining both a socket and a tang for fastening on the handles, by which means the same tool will answer both as a hand and a morticing chisel.

Joseph Lillie, of Manchester, engineer, *for certain machinery or apparatus applicable for purifying and cooling liquids, and for purifying, cooling, and condensing gases.* Patent dated September 21, 1848.

This invention consists, first, of an apparatus for cooling wort or other liquors by allowing them to fall, like rain, through the atmosphere. The liquor runs into a bowl, perforated, and mounted on a spindle, which is made to revolve. By the centrifugal force and gravity of the liquor, it is driven out and falls into a vat underneath. The vapour is carried off by a hood over the vat, and having a fan connected with it; or the apparatus may be stationary, and the liquor be subjected to pressure to cause it to flow as described.

The same principle may be applied to the purification and cooling of gases, by exposing them, in a suitable vessel, to the action of a shower of purifying liquors.

Andrew Paton Halliday, of Manchester, manufacturing chemist, *for certain improvements in the manufacture of pyroligneous acid.* Patent dated September 28, 1848.

This invention consists in an improved apparatus for the production of pyroligneous acid. The ordinary process is to carbonize the materials in a common retort and collect the gas evolved, which is then cooled down, but this process does not extract all the acid from the wood. The patentee proposes to break up the wood or other materials, and to pass them through a retort by means of a screw working in it. They are fed into one end by a vertical screw, and when delivered at the other end, fall into a trough of water, forming a water joint. By this means the materials are more equally exposed to the proper heat and the acid more effectually extracted. The speed with which the materials are passed through by the screw may be varied to suit the various vegetable substances used.

Thomas Metcalfe, of High-street, Camden Town, Middlesex, gentleman, *for improvements in the construction of chairs, sofas, and other articles of furniture for sitting and reclining on.* Patent dated 5th October, 1848.

The object of the inventor is to make chairs, &c., portable, by constructing them of cross frames of iron, free to move in certain positions on hinges or pins, so that, when not in use, they will fold up to the thickness of one frame, the cushion or seat being carried by canvas or other suitable material. By combining these frames, sofas or bedsteads may be likewise formed.

Edward John Massey, of Liverpool, *for improvements in apparatus for measuring the speed of vessels and streams, and for ascertaining the depths of water.* Patent dated October 5, 1848.

The first part of this invention consists of a paddle-wheel, enclosed in a case, leaving half to be acted upon by the water. At the end of the wheel spindle is a crank and connecting rod, which actuates a beam over head, at the other end of which is a rod taking into the teeth of a ratchet wheel, provided with counting apparatus. The second part consists of the ordinary spiral rotator, to which a similar crank and counting apparatus is attached, and an arrangement is described for raising and lowering the apparatus by means of a frame attached to the vessel and a handle on deck. The third part consists of adapting the first described wheel to a self-registering sounding machine. The wheel revolves while it is being lowered, and is held by a ratchet from returning. The revolutions are counted as above.

Robert Stirling Newall, of Gateshead, Durham, *for improvements in locks and springs, and in the means of fastening and setting up the rigging in ships.* Patent dated September 28, 1848.

The first part of this invention consists of a new method of constructing locks, in which the bolt is shot by the partial rotation of a ring held in its place by two or more pins running through the loose ring and a fixed one; the pins being pressed back by the entrance of the key against india-rubber springs.

The second part consists of a combination of iron and vulcanised india rubber to form springs. The india rubber is inclosed in a wrought-iron case separated into cells by thin plates of iron, and in these cells are smaller blocks of india rubber, which are kept in their central position by short pins in the plates.

The third part consists of a method of arranging screw links in such a manner that the threads shall not be exposed to the action of the salt water. This is effected by screwing a rod into a socket screwed right handed outside and left handed inside, the outside working into another socket. By turning the middle socket the rod and lower socket will be screwed together or asunder, while both threads are protected. Hempen laniards are to be used to facilitate cutting away the shrouds in an emergency.

John Bethell, of Parliament-street, Westminster, gentleman, *for improvements in preserving animal and vegetable substances; and also stone, chalk, and plaster from decay.* Patent dated August 21, 1848.

The first part of this invention consists in drying and smoking wood, for which purpose it is exposed to the hot air and smoke of a kiln suitably constructed, peat or coal tar being used as fuel on account of their anti-septic qualities. Surcharged steam may also be used, after being passed through liquid anti-septics, to produce a like effect. For preserving meat, the patentee proposes to inject a mixture of one gallon of wood naptha to four of water, salt being added in the usual proportions for brine. Meat may be further preserved by slicing and desiccating it, and then packing it in canisters, with carbonic acid gas under pressure. Animal matters may be preserved for manures by being treated with bituminous and resinous oils, pyroligneous acid, &c., and then drying them. The second part consists in preserving liquors, milk, &c., by combining them with carbonic acid gas under pressure. The third part consists of a machine for drying grain, which consists of a case with endless webs and rollers, which are set in motion so as to carry the grain slowly from web to web, whilst it is exposed to heated air. Fourthly, in preserving articles of porous stone, chalk, &c., by steeping them in the above-mentioned anti-septics.

Joseph Gillot, and John Morrison, of Birmingham, *for improvements in ornamenting cylindrical and other surfaces of wood and other materials.* Patent dated December 28, 1848.

This invention consists in ornamental pen-holders and similar articles, by passing them through revolving dies, and also by causing the cylindrical piece of material to revolve either entirely or partially, by which means a great variety of patterns can be obtained; the present mode being only to draw the cylinder through a stationary die, thereby forming only simple flutes in a straight line.

William Wilkinson Nicholson, of Acton-street, Gray's-inn-road, civil engineer, *for improvements in machinery for compressing wood and other materials requiring such a process.* Patent dated September 28, 1848.

This machine is more particularly adapted for compressing railway wedges, and consists of two compressers, worked by a toggle-joint, off a cam on a horizontal shaft beneath. This shaft gives motion by a pair of bevil-wheels to a vertical shaft, a crank on which moves a table backwards and forwards to push in fresh wedges to the compresser-boxes, the entrance of the uncompressed wedges driving out those previously in the boxes. A roller machine is also described, in which the wedges are compressed by passing through a series of rollers. In the same machine, the blocks may also be planed to an uniform size, by passing them over a series of plane irons. (The patentee proposes to plane them *after* they have been compressed: for many reasons, it would be better to plane them previously.) To compress treenails, they are forced by the action of a piston through a revolving die-plate, there being two pistons worked off a crank, and the die-plate making a semi-revolution for each stroke of the pistons, so that the compressed treenail shall be forced out by the next one. The patentee claims for his system the advantage that the elasticity of the wood will not be destroyed, as is the case where it is exposed to pressure for a great length of time.

William Wheldon, engineer to Messrs. John Warner and Sons, of Jewin Crescent, in the City of London, brassfounders and engineers, *for improvements in pumps or machinery for raising or forcing fluids.* Patent dated September 4, 1848.

This invention consists in dispensing with the link necessary to connect the end of the pump-rod with the end of the lever working it, when such lever is mounted on a fixed fulcrum. This is effected by making the fulcrum of the lever a vibrating standard, fixed at bottom to the flange of the pump.

Robert Walter Winfield, of Birmingham, merchant and manufacturer, and John Ward, of Birmingham, aforesaid, a workman in the employ of the said Robert Walter Winfield, *for certain improvements in the manufacture of tubes, and in the manufacture of certain articles made in part of tubes.* Patent dated September 14, 1848.

This invention consists in a novel method of making taper tubes by drawing them on a mandril through a draw plate, which is to be made of soft metal, which will gradually extend, and produce a tapering tube. The tube may also be fluted, and the flutes twisted spirally, by giving a proper revolving motion either to the draw-plate or mandril. The second part consists in forming brass-tubing of two thicknesses, the joints being placed opposite each other, and the tube being again drawn, so as effectually to prevent any leakage at the joints.

Richard Laming, of Clichy la Garonne, near Paris, in the Republic of France, chemist, *for improvements in the modes of obtaining or manufacturing sulphuric acid and sulphur.* Patent dated September 4, 1848.

This invention consists, first, in employing pumicestone, or other cheap porous substance, which is to be boiled in concentrated sulphuric acid; then immersed in water, containing twenty per cent. of ammonia, heated in a retort to 600 degrees, with one per cent. of peroxide of manganese, and then allowed to cool without the admission of atmospheric air. By this treatment its catalytic effect is much increased, and the acid is produced by the action of sulphurous acid gas and atmospheric air, and a small proportion of ammoniacal gas, on this pumice-stone. The apparatus consists, first, of a cylindrical vertical vessel, divided by horizontal divisions into four chambers; the divisions having slides by which a connection is made between the compartments. The top is covered with an air-tight cap. By this arrangement the catalytic substance in the lower compartment can be renewed when exhausted, without interfering with the working of the apparatus, by first filling the top compartment, then emptying the lower one, and finally opening the slides between the upper and lower, by which the substance will fall into the two central chambers. The gases, after passing through this vessel, are conducted into a condenser, consisting of a number of vertical pipes of earthenware, standing on a cistern to which they are connected by a water-joint; they are also connected in pairs at the top. The insides of these tubes are fitted with shelves, containing pumice-stone, or other similar substance, openings being left in the shelves for the passage of the gas. Division is fitted under every pair of tubes, but only for part of the depth of the cistern, and dipping into water, with which the cistern is partially filled. By this means a continuous passage through the pipes is afforded to the gas, the uncondensed portion of which finally enters a leaden receiver, which communicates with a chimney in order to keep up a draught through the apparatus. Water is supplied to the top joints of the pipes, and, as it falls, passes over all the shelves containing the pumice-stone, carrying the acid with it to the compartments in the cistern. The acid may be concentrated by passing it through a pipe provided with shelves, and exposing it to the action of heated air, or by the application of external heat. A similar apparatus is proposed for the production of nitric acid.

The patentee also proposes to obtain the sulphur from the ammoniacal liquor of gas works by introducing a mineral acid into the ammoniacal liquor, and mixing the sulphuretted hydrogen and carbonic acid gas so generated into a vessel containing sulphurous acid. The two last are reagents, and the sulphur is deposited.

LIST OF ENGLISH PATENTS

From the 24th July, 1849, to the 16th August, 1849, inclusive.

John Holt, of Todmorden, Lancaster, manager of the Waterside Works, for improvements in machinery or apparatus for preparing cotton and other fibrous substances, parts of which improvements are applicable to machinery used in weighing. Patent dated July 24; six months.

Alexander Ferrier Rose, of Greenvale-place, in the city of Glasgow, North Britain, gentleman, for a certain improvement or certain improvements in the process or operation of printing, and in the machinery or apparatus employed therein. Patent dated July 24; six months.

Joseph Woods, of Barge-yard Chambers, Bucklersbury, civil engineer, for improvements in bleaching certain organic substances, and in the manufacture of certain products therefrom. Patent dated July 24; six months.—(Communication.)

George Fellows Harrington, of Portsmouth, dentist, for improvements in the manufacture of artificial teeth, and the beds and palates for teeth. Patent dated August 1; six months.

Florentin Joseph de Cavaillon, of Paris, chemist, for certain improvements in obtaining carbonated hydrogen gas, and in applying the products therefrom to various useful purposes. Patent dated August 1; six months.

Eugene Alexandre Desire Boucher, of Rue des Vinnegaries, Paris, metal merchant, for certain improvements in the manufacture of cards. Patent dated August 1; six months.

Jerome Andre Drien, of Manchester, machinist, for certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith. Patent dated August 1; six months.

Benjamin Thompson, of Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron. Patent dated August 1; six months.

Thomas Potts, of Birmingham, Warwick, manufacturer, for improvements in apparatus used with curtains, blinds, maps, and plans. Patent dated August 1; six months.

William Geeves, of Battle-bridge, saw-mill proprietor, for improvements in the manufacture of boxes for matches, and other purposes. Patent dated August 1; six months.

Julian Edward Disbrowe Rodgers, of High-street, Pimlico, Middlesex, professor of chemistry, for improvements in the manufacture of white lead. Patent dated August 1; six months.

David Harcourt, of Birmingham, for improvements in vices, and in the manufacture of hinges; and also in apparatus for dressing and finishing articles made of metal. Patent dated August 1; six months.

Adam Yule, of Dundee, master mariner, and John Chanter, of Lloyds, gentleman, for improvements in the preparation of materials for coating ships and other vessels. Patent dated August 1; six months.

Richard Kemsley Day, of Stratford, in the county of Essex, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. Patent dated August 1; six months.

John Shaw, of Glossop, musical instrument maker, for certain improvements in air guns. Patent dated August 1; six months.

Augustus Roelm, of Paris, in the Republic of France, gentleman, for improvements in making roads and ways; and in covering the floors of court-yards, buildings, and other similar places. Patent dated August 1; six months.

James Murdoch, of Staple Inn, mechanical draughtsman, for certain improvements in converting sea water into fresh, and in ventilating ships and other vessels: applicable also to the evaporation of liquids, and to the concentration and crystallization of syrups and saline solutions. Patent dated August 1; six months.—(Communication.)

John Parkinson, of Bury, in the county of Lancaster, brass-founder, for improvements in machinery or apparatus for measuring and registering the flow of liquids. Patent dated August 1; six months.

Benjamin Aingworth, of Birmingham, button maker, for improvements in ornamenting iron, and other metals, for use in the manufacture of gun barrels, and all other articles to which the same ornamented metals may be applied. Patent dated August 1; six months.

David Clovis Knab, of Leicester-place, civil engineer, for an improved apparatus for distilling fatty and oily matters. Patent dated August 1; six months.

William Thomas, of Cheapside, merchant, and John Marsh, foreman to the said William Thomas, for improvements in the manufacture of looped fabrics, stays, and other parts of dress; also in apparatus for measuring. Patent dated August 9; six months.

Arthur Howe Holdsworth, of the Beacon, Dartmouth, esquire, for improvements in the construction of marine boilers, and funnels of steam-boats and vessels. Patent dated August 9; six months.

William Furness, of Lawton-street, Liverpool, builder, for improvements in machinery for cutting, planing, moulding, dovetailing, boring, morticing, tongueing, grooving, and sawing wood; also for sharpening and grinding tools, or surfaces; and also in welding steel to cast iron. Patent dated August 9; six months.

John Knowlys, of Heysham Tower, near Lancaster, esquire, for improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat. Patent dated August 9; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in derricks for raising heavy bodies. Patent dated August 9; six months.—(Communication.)

John Ruthven, of Edinburgh, civil engineer, for improvements in propelling and navigating ships, vessels, or boats, by steam and other powers. Patent dated August 10; six months.—(Communication.)

Arthur Dunn, of Worcester, soap maker, for improvements in marking soap. Patent dated August 16; six months.

Frederick William Bodmer, of Paris, civil engineer, for certain improvements in machinery or apparatus for letter-press printing. Patent dated August 16; six months.

Richard Archibald Brooman, of Fleet-street, London, for improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating substances. Patent dated August 16; six months.

Jonathan Blake, of Mount Pleasant, Eaton, in the City of Norwich, surgeon, for certain improvements in lamps. Patent dated August 16; six months.

James Young, of Manchester, manufacturing chemist, for improvements in the treatment of certain ores and other matters, containing metals, and in obtaining products therefrom. Patent dated August 16; six months.

Louis Lemaitre, late of Paris, in the Republic of France, but now of the Hotel de l'Univers, Blackfriars, engineer, for improvements in the manufacture of ferules: for fixing the tubes of locomotive and other boilers. Patent dated August 16; six months.

LIST OF PATENTS

That have passed the Great Seal of Scotland, from the 22nd day of May, to the 22nd day of June, 1849, inclusive.

Moses Poole, London, Middlesex, gentleman, for improvements in apparatus for drawing fluids from the human or animal body. Sealed May 23; six months.

William Newton, of London, Middlesex, civil engineer, for improvements in the jacquard machine. Sealed May 28; six months.

Henry Vint, of St. Mary's Lodge, Colchester, in the county of Essex, gentleman, for improvements in propelling ships and other vessels. Sealed May 29; six months.

Malcolm Macfarlane, of Thistle-street, in the city of Glasgow, North Britain, coppersmith, for certain improvements in machinery or apparatus for the drying and finishing woven fabrics. Dated May 29; six months.

Elijah Slack, of Orchard-street, in the Burgh of Renfrew, North Britain, gum manufacturer, for an improvement or improvements in the preparation of materials to be used in the manufacture of textile fabrics. Sealed May 31; six months.

Edward Buchler, of the city of London, merchant, for improvements in the manufacture of boots and shoes, also applicable to other fabrics. Sealed June 5; four months.

Jacques Hulot, of Rue St. Joseph, Paris, in the Republic of France, manufacturer of fabrics, for improvements in the manufacture of the fronts of shirts. Sealed June 7; six months.

Thomas Greenwood, of Goodman's Fields, in the city of London, sugar refiner, and Frederick Parker, of New Gravel Lane, Shadwell, animal charcoal manufacturer, for improvements in filtering syrups and other liquors. Sealed June 8; six months.

William Ironside Tait, of Rugby, in the county of Warwick, printer and bookseller, for an improved method or methods of producing outlines on paper, pasteboard, parchment, papier maché, and other like fabrics. Sealed June 8; four months.

George Simpson, of Buchanan-street, in the city of Glasgow, North Britain, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies, such improvements being applicable to various useful purposes. Sealed June 11; six months.

Joseph Harrison, of Blackburn, in the county of Lancaster, machine maker, for certain improvements in, and applicable to, looms for weaving. Sealed June 11; four months.

William Gratrix, of Salford, in the county of Lancaster, bleacher and dyer, for certain improvements in the method or process of drying and finishing woven and other fabrics, and in the machinery or apparatus for performing the same; part of which improvements is applicable to stretching woven fabrics. Sealed June 12; six months.

Osgood Field, of London, merchant, for improvements in anchors. Sealed June 14; six months.

Robert Nelson Collins, of Oxford-court, Cannon-street, in the city of London, wholesale druggist, for certain improved compounds to be used for the prevention of injury to health under certain circumstances. Sealed June 14; six months.

Walter Neilson, of Hyde Park-street, in the city of Glasgow, North Britain, engineer, for an improvement or improvements in the application of steam for raising, lowering, moving, or transporting heavy bodies. Sealed June 25; six months.

David Smith, of the city of New York, in the United States of America, lead manufacturer, and a citizen of the said United States, for certain new and useful improvements in the means of manufacturing certain articles in lead. Sealed June 25; six months.

Edmund Grundy, of Bury, in the county of Lancaster, woollen manufacturer, and Jacob Farrow, of the same place, manager, for certain improvements in machinery or apparatus for preparing wool for spinning, and also improvements in machinery or apparatus for spinning wool and other fibrous substances. Sealed June 25; six months.

Robert William Laurie, of Carlton-place, in the city of Glasgow, North Britain, merchant, for improvements in means or apparatus to be employed for the preservation of life and property, such improvements, or part thereof, being applicable to various articles of furniture, dress, and travelling apparatus. Sealed June 25; six months.

Edward Hawkins Payne, of Great Queen-street, in the county of Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, for improvements in the manufacture of coach-lace, and other similar looped or cut pile fabrics. Sealed July 9; six months.

Robert Urwin, of Ashford, in the county of Kent, engineer, for certain improvements in steam engines, which may in whole or in part be applicable to pumps, and other machines not worked by steam power. Sealed July 9; six months.

William Wilson, junior, residing at Campbellfield, Glasgow, in the county of Lanark, Scotland, for improvements in cutting plastic tubes or tiles. Sealed July 10; four months.

James Godfrey Wilson, of Millman-row, Chelsea, in the county of Middlesex, engineer, for certain improvements in obtaining perfect combustion, and in apparatus relating thereto, the same being applicable generally to furnaces and fire-places, as also to other purposes where inflammable matter or material is made use of. Sealed July 11; four months.

William Crofton Moat, of Upper Berkeley-street, in the county of Middlesex, surgeon, for improvements in engines to be worked by steam, air, or gas. Sealed July 16; six months.

William Kenworthy, of Blackburn, in the county of Lancaster, cotton spinner, for certain improvements in power looms. Sealed July 16; four months.

George Benjamin Thorneycroft, of Wolverhampton, in the county of Stafford, ironmaster, for improvements in manufacturing railway tyres, axles, and other iron, where great strength and durability is required. Sealed July 16; six months.

Edward Ives Fuller, of Margaret-street, Cavendish-square, in the county of Middlesex, carriage-builder, and George Tabernacle, of Mount-row, Westminster-road, in the county of Surrey, coach-ironfounder, for certain improvements in metallic springs for carriages. Sealed July 17; six months.

Peter Augustine Godefroy, of Wilson-street, Finsbury-square, chemical colour manufacturer, for certain improvements in dressing and finishing woven fabrics. Sealed July 18; four months.

John Grantham, of Liverpool, engineer, for improvements in sheathing ships and vessels. Sealed July 18; six months.

Joseph Eccles, of Moorgate Fold Mill, near Blackburn, in the county of Lancaster, cotton-spinner and manufacturer, and James Bradshaw, and William Bradshaw, of Blackburn, in the same county, watch-makers, for certain improvements in, and applicable to, looms for weaving various descriptions of plain and ornamental textile fabrics. Sealed July 19; four months.

Francis Alton Calvert, of Manchester, in the county of Lancaster, merchant, for certain improvements in machinery for cleaning and preparing cotton wool, and other fibrous substanees. Sealed June 19; four months.

Charles Augustus Holm, of the Strand, engineer, for improvements in printing. Sealed June 19; six months.

Thomas Harcourt Thompson, civil engineer, of Blackheath Hill, in the county of Kent, for certain improvements in apparatus for preventing the rise of effluvium from drains, sewers, cesspools, and other places; and in apparatus and machinery for regulating the level of water in rivers, reservoirs, and canals. Sealed June 22; six months.

LIST OF PATENTS

That have passed the Great Seal of Ireland, from the 28th day of May, to the 11th day of July, 1849, inclusive.

Elijah Slack, of Orchard-street, in the Burgh of Renfrew, North Britain, gun manufacturer, for improvement or improvements in the preparation of materials to be used in the manufacture of textile fabrics. Sealed May 28; six months.

John Bethell, of Parliament Street, in the city of Westminster, for certain improvements in preserving animal and vegetable substances, and also stones, bricks, and articles made of clay, and chalk, and plaster, from decay. Sealed June 1; six months.

Alexander Munkittrick, of Manchester, in the county of Lancaster, merchant, for an improved composition of matter, which is applicable as a substitute for oil, in the lubrication of machinery and for other purposes. Sealed June 2; six months.—(Communication.)

Joseph Deeley, of Newport, in the County of Monmouth, engineer and ironfounder, for improvements in ovens and furnaces. Sealed June 13; six months.

Robert Brett Schenck, late of New York, in the United States of America, at present of Belfast, in the county of Antrim, manufacturer, for a machine for buffing and scutching flax, hemp, and other fibrous substances. Sealed June 18; six months.

James Hamilton, of London, civil engineer, for improvements in cutting wood. Sealed June 28; six months.

Michael Loam, of Treskerly, in the parish of Gwennap, in the county of Cornwall, engineer, for improvements in the manufacture of fuzees. Sealed June 30; six months.

David Smith, of the city of New York, in the United States of America, lead-manufacturer, for certain new and useful improvements in the means of manufacturing certain articles in lead. Sealed July 7; six months.

William Newton, of Chancery-lane, civil engineer, for improvements in the jacquard machine. Sealed July 11; six months.

PATENT LAWS REFORM.

REPORT OF THE COMMISSION.

In the *Artizan* for September, 1848, we stated that a Commission or committee had been appointed by the Government ostensibly to enquire into the Privy Seal and Signet Offices, but really to ascertain the state of the present system of granting patents in the United Kingdom.

We have now to inform our readers that this Committee has made a Report, embodying many recommendations of the first importance. Prominent among the amendments proposed, are some of those pointed out by Mr. Campin, in his petition to the House of Commons, presented in the spring of 1848, and given in this journal for October, in the same year.

The committee examined Mr. Campin and all the principal patent agents, T. Webster, Esq., barrister, the well known author of a treatise on Patent Law, &c., and Bennet Woodcroft, Esq., C.E., and have collected an overwhelming mass of evidence as to the defective character of the present system and the absolute necessity of an improvement therein.

A few brief extracts from this evidence appended to the Report will explain the tendency of the present practice and the importance of the amendments recommended. We give the recommendations of the committee first, as even a few brief extracts will take up much of our space, and therefore require us to postpone some part thereof till our next number.

"The object for granting a patent for an invention is, not merely to secure to an inventor the fair reward of his labour and ingenuity, but also to benefit the public by encouraging such inventions; and it is essential that the Crown should have some tribunal to refer to for advice before making such grants. That it has not appeared to them that any better course can be devised than a reference to the Attorney or Solicitor-General, to inquire into the merits of the circumstances set forth in the petition, and report thereon to the Crown. The inquiry would appear, for the most part, to involve considerations rather of a legal than of a scientific nature. But should questions arise on an opposed petition, where a more than ordinary familiarity with scientific subjects might seem requisite for the due comprehension of the matter under investigation, the Attorney or Solicitor General would always have the power, which they now possess and exercise, of calling in some man of practical science, unconnected with the parties before them, and unprejudiced in the matter in dispute, to aid them in coming to a just decision. Ample opportunity having been given for making opposition at this stage of the proceedings, no adequate advantage is derived from a second opposition at the Patent Bill Office. It seems, however, that oppositions at that stage are of unfrequent occurrence."

"If this opinion should be adopted, and the proceedings at the Patent Bill Office be dispensed with, they then recommend that some public notice, by advertisement in the *Gazette* or otherwise, should be given that a patent for a particular object has been applied for, not naming the applicant, or giving more than a very general description of the object of the invention: and that a sufficient number of days should be allowed from the date of the advertisement, before proceeding with the petition, in order that a fair opportunity for opposition may be afforded to parties desirous of opposing the grant sought for. We also recommend *that an outline description*, such as is now required to *be deposited with the Attorney or Solicitor-General* in cases of opposed patents, should be required to be lodged, under seal, with every petition on its first presentation at the Home Office. It is not proposed that this outline description or specification should supersede the specification now required to be enrolled in Chancery, nor that it should be required to enter into the details of the invention; but that it should be considered binding as to the principles of it. With these provisos we think that *a patent when granted might take its date from the day on which the petition is presented;* instead of, as at present, from the day on which the patent is sealed."

"We also recommend, that in lieu of requiring successive payments of fees and stamp duties at the several public offices, a stamp should be affixed to the Queen's Bill in the department in which it is prepared."

"In the case of patents of appointment to office, the amount of this stamp might be a small per centage on the salary of the office."

"In the case of patents for inventions, a stamp of uniform value, without reference to the number of names included in the grant, should suffice. Should it be determined to extend the power of granting patents under the Great Seal of the United Kingdom to Ireland and Scotland, we are disposed to recommend that, for a patent extending over the United Kingdom, the Channel Islands, and the colonies, a stamp of £50 should be required. But, if it should be thought inexpedient to debar inventors from taking out patents for England alone, in that case it is recommended that a stamp of £30 should be imposed on patents for England, with the Channel Islands and colonies; with an addition of £20 for Scotland and Ireland, or of £10 for either Scotland or Ireland separately."

"We think such an arrangement would afford satisfaction to patentees, and would, at the same time, compensate the revenue for the loss which it would sustain by the adoption of the course we have recommended. We do not make any suggestions in regard to the proceedings before the Lord Chancellor.

"With respect to specifications and their emolument, we think it of great importance to a party applying to take out a patent for an invention to ascertain what patents in relation to the same object have been previously taken out; otherwise, after he has incurred considerable expense in perfecting his invention and obtaining a grant, some previous patent may be discovered which may vitiate his patent by destroying its originality."

"For this, and other reasons, it would seem very desirable that specifications should be made more available to the public than they are at present."

"It has already been stated, that specifications have been hitherto enrolled in three different offices, searches in all of which must frequently be made before a party, seeking to obtain a patent for a new invention, can satisfy himself that no similar patent has at any time previously been granted; and from the absence of indices, or proper classification, these searches must always be attended with great uncertainty, and often with great expense; and the difficulties of such a search are enhanced by the specifications being copied on rolls in an engrossing hand. It is, therefore, recommended that these specifications should be entered in book-form in a common hand, and that *proper indices should be made of them.* They would then become valuable references for the public."

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION, OF THE NEW ROYAL EXCHANGE.

(Continued from page 192.)

Bar, Clerks' Room, Room in Tower, Secretary's Room, and Passage and Staircase to Second Story, all in First Story and connected with Lloyd's Rooms.—Lath, plaster, float, and set ceilings; moulded cornice 36 inches girt, round the secretary's room, with three enrichments, one 3-inch, one 2-inch, and one $1\frac{1}{2}$-inch girt, and fix a flower 3 ft. 6 in diameter. Fix in all the other rooms cornices 24 inches girt, brackettings 18 inches girt to large cornice, and 12 inches to the other, and bracketting to soffits in angles of secretary's room and elsewhere; all the sides to be finished trowel stucco for paint; all soffits finished the same, with beads and quirks; partitions extra lathed, and strings of the wood staircase to be done like ceilings.

Second Story of Lloyd's Room.—Lath, plaster, float, and set all ceilings

of the upper rooms and passages, and work cornices 9 inches girt round two rooms; all the sides trowelled stucco for paint, including all soffits which are to have beads and quirks.

Water-Closets, Urinals, Retiring Rooms, and Lobbies connected with them.—Generally, those sides and ceilings not covered with wood to be plastered, and finished to correspond with adjoining and similar parts on the same stories, except as follows:—

The arched soffit of doorway to lobby, and the sides and ceilings of lobby and water-closets in basement of the Royal Exchange Assurance offices, rendered and floated in Roman cement for paint. The sides and ceilings of water-closets on the basement story of the Banking-house, and the sides and ceilings of the two retiring rooms adjoining the staircase to Lloyd's rooms, to be also rendered and floated in Roman cement for paint. The sides of water-closets in basement of shops, not lined, to be also finished the same. The sides and ceilings, where there are arches or ceiling floors of lofts, or cistern rooms over water-closets, to be rendered two coats and set, putting lathing where needful.

All the stone staircases and landings, and all passages, lobbies, and entrances connected with staircases, and not otherwise described, to have mastic two reeded flush plinth, scribed to moulded steps, with all ramps, mitres, and mitred returns needful.

Generally, to run and work all arris and quirks, and work all mitres, stops, and returns required.

All the modelling to be done by competent persons, from the drawings of the architect, and the contractor is to provide for the payment of 70*l.* to modellers for this purpose. All the enrichments to be finely cast, trimmed, and accurately fixed, and the contractor to find and fix 271 mitre or angle leaves to the enrichments, of the averaged sizes required. A moiety in quantity of the enrichments described will be required to be hollow, trimmed, and put up separately; all flowers also are to be formed in the same manner, and to be fixed with screws; and the contractor to provide and securely fix 30 blocks in ceiling, with strong bolts and brass hooks.

The contractor to execute other enrichments, beyond what are shown and described, for the court-room of the Royal Exchange Assurance offices, to the extent in value of 20*l.*; and he is also to work and form panels in sides of staircases, and other places, beyond what are shown or have been described, and as will be hereafter directed, to the extent in value, beyond the plain work to sides taken, of 100*l.* The contractor is also to execute additional plastering, or additional enrichment or panelling to the plastering described, beyond what is shown or specified, to the extent in value of 250*l.*

The contractor to provide all materials and labour, and execute in a masterly style, the stucco work to the sides and ceilings of Lloyd's rooms—viz., the two great rooms, the captains' room, the reading room, and the large landing and lobby between the rooms, but not landing of staircase; all on one-and-a-half laths, with wrought iron nails, as follows:—

Ceilings.

Yds.	Ft.		
318	0	sup.	Ceilings in panels, average 4 ft. square.
303	0	„	Ditto, ditto, with circular ends.
396	0	„	Ditto, elliptical and circular.
	874	„	Groined ceilings.
	1962	„	Coves.
	1980	„	Flat domes on elliptical plans (No. VIII).
	1180	„	Pendants of domes (No. XL).
	3180	„	Beams, fascias, and margins.
	2123	„	Ditto, circular and elliptical.
	1872	„	Margins, circular both edges.
	3126	„	Mouldings.
	1827	„	Ditto, in short lengths.
	1640	„	Ditto, circular.
	1872	„	Ditto, elliptical.
	3127	run	Arrises.
	1814	„	Circular ditto.
	2640	„	Elliptical ditto.
	1817	„	Enrichments $2\frac{1}{2}$ inches girt, cast and fixed.
	735	„	Ditto, circular and elliptical.
	1964	„	Enrichments 6 inches girt, ditto.
	2763	„	Ditto, circular and elliptical.
	2840	sup.	Enrichments, cast and fixed.
	1523	„	Ditto, circular and elliptical.
	No.		
	1836		Mitres to moulding, average 13 inches girt.
	2640		Mitre leaves to enrichments, cast and fixed, average $4\frac{1}{2}$ inches girt.
	384		Brackets 2 feet high, 12 inches projection, and 9 inches wide, enriched on three faces, cast and fixed; three patterns.
	427		Panels averaging 9 inches, sunk 1 inch, with enriched moulding, fixed and mitred $1\frac{1}{2}$ inch girt; three patterns.
	427		Flowers 7 inches diameter, and 6 inches deep, cast and fixed in panels; six patterns.

The contractor to execute panels, shields, and other decorations and enrichments, beyond what are herein provided, for various parts of Lloyd's rooms, to the extent in value of 350*l.*; and he is also to provide for the payment of the sum of 150*l.* for models to be made from the drawings of the architect for the decoration of these rooms and places.

Work to sides of these Rooms and Places.

Yds.	Ft.		
1400	0	sup.	Trowel stucco, in compartments.
180	0	„	Ditto, circular.
	1600	„	Margins, jambs, &c.
	720	„	Ditto, elliptical.
	980	„	Arrises and narrow margins.
	464	„	Ditto, circular.
	2410	„	Keen's cement in margins and narrow compartments.
	1800	„	Mouldings, in ditto.
	No. 427		Mitres, averaging 9 inches girt.

The contractor to execute decorative frontispieces to 24 windows or corresponding recesses, as will be directed, to the extent in value of 7*l.* each.

The contractor is also to execute panelling and other decorations to the sides, as will be directed by the architect, to the extent in value of 150*l.*

EXTERNAL PLASTERING.

Including bracketting and ceiling floors; sides and ceilings of ambulatory, portico, archway, in east façade under tower, and four other entrances.

Ambulatory.—Form ceiling floor under arches over ambulatory, with girders, binders, ceiling joists, and bracketting. The main beams with 64 flitches 15 in. by 5, bolted with $1\frac{1}{4}$-inch bolts, 3 ft. 6 apart, to the main iron beams. The other beams to be framed by double tiers of binders, 15in. by 4, framed $2\frac{1}{2}$ inches into main beams. To provide and fix 256 straps $1\frac{1}{2}$ in. by $\frac{1}{2}$, corked down with staples at each end 2 ft. 6 long, to secure ends across main beams. Also 16 straps to hold up binders to iron beams at the angle of ambulatory, to weigh 40 lbs. each.

Plate all round both sides 5 in. by 3, ceiling joists to the whole 7 in. by $2\frac{1}{2}$; two-inch bracketting from 2 in. to $3\frac{1}{2}$ deep, to soffits of large beams, to sides of panels, and to cornices. Two circular ribs, 7 in. by 3, in two thicknesses, to each large bracket, let into stone templates. Bracketting to spandril sides of brackets 4 in. by $2\frac{1}{2}$. Lath, plaster, and finish the whole of the ceiling, and all decorations in stucco, as is shown and described in plan No. III., in sections Nos. XIII. and XIV., in drawing No. XXI., and generally in other drawings. All the sides of Ambulatory not covered with stone to be coated with Hamlin's patent oil mastic.

Portico and West Entrance.—The four small semis to be finished in mastic plain; the two large semis also in mastic: each of these will have a moulded architrave or band, 2 ft. by 9 girt, in mastic; and the contractor to execute panels and decorations to these two large semis to the extent in value of £200.

The three arched ceilings to be formed of ribs; those to the smaller ceilings to be 9 in. by $4\frac{1}{2}$ net, the inner edge cut true, the outer edge left

rough, got out in three thicknesses, and bolted with twenty ⅝-inch bolts to each; five ribs will be required to each of the two ceilings. The ribs to the larger ceiling will be 12 in. by 4½, made in the same manner; they are to be tenoned into the stone architrave; seven will be required, and they are to be bolted with 30 bolts to each. The five horizontal binders at the back to be 8 in. by 4½, let into brickwork at each end, on oak templates 30 in. by 9 by 6, and notched and bolted to the ribs with ¾-inch bolts in each of the small ceilings, and 9 similar to the great ceiling 10 in. by 4½. Upon this skeleton framework fix ceiling joists 3 in. by 2½, forming three plain arched ceilings, and construct upon them, with 2-inch framed bracketting, rails, styles, margins, with sides and returns to form 35 hexagonal panels to large ceiling, 9 ditto to each of the smaller ceilings, 24 lozenge panels to large ceiling, 4 ditto to each smaller ceiling, 24 triangular panels to large ceiling, 12 ditto to each smaller ceiling, and 1 long panel to large ceiling, and 2 horizontal long panels 1 ft. 3 wide, of the same character, and with similar enrichment, to each of the smaller ceilings. The large hexagonal panels to be in two sinkings, each of 7 inches, and to be worked in stucco, and fix round each panel; and in each sinking a plain stucco moulding 7 inches girt mitred, and in the lower sinking provide and fix deep enriched flowers 2 ft. 9 diameter, to project 13 inches, and to be fixed with large screws. The lozenge panels to be also in two sinkings of 3½ inches deep each; and round the first sinking a moulding 3 inches girt is to be worked; and in the inner sinking is to be fixed an enriched lozenge patera, projecting 3 inches, fixed with screws. The smaller triangular panels to be each in one sinking of 4 inches, with moulding round to girt 3 inches: no enrichment will be required to these panels. The long panel to be sunk out 6 inches; a moulding round 4 inches girt, and an enrichment 12 inches girt, trimmed and put up in short lengths, and centred with an enrichment to form centre worked by hand.

The ceiling joists described will form the surface of the larger and deep panels, but those which are not sunk the same depth will require to be firred out.

West Entrance.—The plain ceiling between arches to be in stucco on double laths, the mouldings and fascia round to girt 2 ft. 6; 18-inch bracketting for cornice. The other plain inner ceiling the same; plain cornice 15 inches girt, and bracketting 7 inches.

The north and south sides under this ceiling to be worked in mastic, including triple keystones, and circular soffits 1 ft. 7 wide, over the doorways.

East Entrance under Tower.—The groined ceiling, and the two semi spandrils, to be executed in mastic.

North and South Entrances.—The two plain circular soffits in each, and the soffits which are circular in upright section, but elliptical in cross and horizontal sections, including long panel in one, and three panels in the other, to be finished in mastic; the rails and stiles dubbed out 3 inches. Moulding, including raised panel, 15 inches girt.

East Entrance from East Area.—The semi recesses over shop fronts, mastic; the ceilings and cornice like those to west entrance. Frame a ceiling floor as follows: four binders 7 in. by 3; ceiling joists 4 in. by 2.

All the mastic and stucco work to this external plastering to be jointed and distempered, including all enrichments.

The contractor to provide for the payment of 50*l.* for modelling the enrichments of these external ceilings. And he is to execute a centre ornament in panel in one of the entrances, as shall be directed, to the extent in value of 10*l.*

All values and amounts of provisions for additional and extra works, given in this specification of plastering, are the prime-cost value of the labour and materials necessary for their execution; and all these works, as well as all the works provided to be done in Lloyd's rooms, for which specified quantities are given, are to be measured, and all works done beyond the quantities provided, and which exceed in value the sums provided are to be valued as extras, according to the provisions of the contract, and paid for accordingly; and all or any part of such quantities of works provided, and of provisions in money for works to be done, which may not be executed, are to be valued as omissions, according to the conditions of the contract, and allowed for by the contractor as a set-off accordingly.

PLUMBER.

All the lead to be the best refined *Newcastle* W.B. lead. If required, all the lead work shall be cast from the pig, in the presence of the architect, or some person appointed by him for that purpose. To execute all plumber's work shown in the drawings and herein described, and also all plumber's works needful to complete other work and the intended buildings.

All flats to be covered with 8-lb. lead, lapping 8 inches at joints, turning up 7 inches against all upright parts against which it abuts, and passing 7 inches at all drips. All gutters to be lined with 8-lb. lead, to turn up on slopes, unless otherwise shown, 11 inches, and 7 inches against upright parts. All cesspools 12 inches deep, to be lined with 8-lb. lead, with strong soldered angles: all lead in gutters and cesspools to lap 7 inches. Lay 6-lb. lead flashings to sloping skylights, dressed down, 2 feet wide at top and bottom, 14 inches wide to sides. Solder into all cesspools a piece of bent 5-inch socket pipe, made of 7-lb. lead, and averaging 2 feet 6 long; 5-lb. milled lead flashings to all parapets, 7 inches wide, and lapping 3 inches at the joints; to all gables stepped in 14 inches wide, in 4 feet lengths, and lapping 3 inches. All flashings in masonry to be burnt in. All flashings in brickwork to be secured with lead wedges and pointed with cement. Valleys lined with 7-lb. lead, 2 feet 4 wide, in 10 feet lengths, lapping 6 inches at each joint. The gutters to be carried over slopes adjoining ends of gutters, with lead the same width and of the same weight; 5-lb. lead flashing, 12 inches wide, to gable of west roof of the London Assurance offices. Stepped flashings to all shafts, as to gables. Lead to turn up on curbs of skylights 6 inches, in skylights on flats; and fix flashings round them 14 inches wide, of 5-lb. lead, the inner edge formed to carry off condensed air. The hips and ridges covered with 6-lb. milled lead, in 8-feet lengths, lapping 6 inches, and 2 feet wide, and to be well secured with lead-headed nails and bale tacks. The lead linings of eaves gutter to great span roof to be 26 inches wide of 8-lb. lead, and fix to them two pieces of 4½-inch socket-pipe 12 inches long, and 2 stacks of 4½ inch cast iron rain pipe, with angle cistern heads, and shoes, to bring water down to lead flat.

Fix in Royal-Exchange Assurances offices two stacks of 5-inch rain pipes, made of 8-lb. lead with strong soldered joints, from the east and west angles of flat down to drains on basement, the two bottom lengths of each, and the shoes, to be cast iron of strong quality. Fix a similar stack of iron and lead pipe, but longer, from the west gutter of span roof over court room; 5-lb. lead flashings, 12 inches wide, to curbs, and 7 inches wide on tops of doors and windows in the same, and 10 inches wide in internal angles of slated curbs, with similar flashings in angles by brick walls. The lead to pass 10 inches over rolls, and 6 inches on slopes of great west roof, which is to be lined with 8-lb. lead; the sheets of lead to be in four lengths each side, and there are to be no drips, but deep flat grooves are to be sunk in the boarding for the laps of lead, so that the upper surface may be flush and even; the top of the under sheet screwed down and dotted; the bottom of the upper sheet secured with strong bale tacks; the screws 4 inches; the bale tacks of 8-lb. lead; the lead to pass 12 inches at the ridge 7-lb. flashings 14 inches wide, burnt into the rakes of gables.

Fix in the London Assurance offices five stacks of similar lead rain pipes, two from the lower roofs, and three from the upper roofs.

Fix in the unappropriated offices two stacks of similar lead rain pipes, with iron pipes at bottom.

Fix in Lloyd's rooms five stacks of similar lead rain pipes, with iron pipes at bottom.

To line the trough under floor, in the Royal-Exchange Assurance offices, with 7-lb. milled lead.

Fix 5-inch cast iron gutter and strong brackets to the eaves of the upper roofs of the London Assurance offices.

The contractor to lay 100 cwt. of lead in extra flats and gutters more than shown and described, and also 30 cwt. of lead in extra flashings more than shown and described, as shall be directed by the architect, and to execute 200 feet lineal of burning in or securing such flashings to stone work.

The contractor to fix in angles of east area 180 feet lineal of 5-inch rain

pipe, made of 8-lb. lead, with soldered joint and handsome astragal bands and tacks; and also four large handsome blocked cistern heads for angles. The joints of the 5-inch iron and 5-inch lead pipes to be flanged and made secure, and the joints of iron pipes fixed internally, to be run with lead; and the contractor to find extra patterns for casting four lengths of iron pipe, with bends to clear offsets.

The contractor to execute sundry extra works in completing and extending the external plumbing work more than shown or described, to the extent of £100 in value.

Internal Plumbing.

The contractor to provide all materials and things, and all labour needful, to fit up and complete all the cisterns, sinks, water-closets, urinals, and other fittings connected therewith, in the various offices and places of the building, as is shown on the plans and described in the specifications, and to use in such works, according to the directions of the architect, the following materials and articles; providing all labour and all customary articles necessary to fix and complete them for use.

Cwt.	qrs.	lbs.	
61	1	21	milled lead and labour in sinks.
188	2	21	ditto ditto cisterns.
250	0	14	

1140 ft. 8 in. run strong soldered angle.

54 Patent pan water-closet, with large queen's ware basins and apparatus, of the strongest and best quality, fixed complete.

9 Ditto, ditto, but with blue basins.

5 Patent valve closets, with large blue printed basins and best apparatus, fixed, complete.

9 Large queen's ware urinal pans, with a brass grate and a bell trap, fixed complete.

9 Sets of valves, wires, pulls, handles, levers, &c.. to urinals.

63 Large lead D traps, made of 8-lb. lead, and fixed with joint.

77 Lead valve boxes, made of 7-lb. lead, fixed and soldered to cisterns.

14 Smaller D traps, made of 7-lb. lead, and fixed at bottoms of waste pipes which enter drains, and to safes.

4 3-inch brass hydraulic lift pumps, with air-vessels and plank, fixed.

Patent lead pipes, including fixing, wall hooks, soldered joints, &c., complete, to weigh as follows:—½-inch, 4 lbs. per yard lineal; ¾-inch, 7¼ lbs. per yard lineal; 1-inch, 12 lbs. per yard lineal; 1¼-inch, 16 lbs. per yard lineal; 1½-inch to services, 21 lbs. per yard lineal; 1½-inch to wastes, 18 lbs. per yard lineal; 2-inch to services, 28 lbs. per yard lineal; 2-inch to wastes, 24 lbs per yard lineal; 2½-inch to wastes, 26 lbs. per yard lineal.

Ft.	In.		
495	0	run	½-inch warning pipe.
117	0	,,	Ditto, extra bent, in services to urinals.
3081	0	,,	¾-inch pipe in services.
910	6	,,	1-inch pipe.
372	0	,,	1½-inch pipe in mains.
627	8	,,	Ditto, in wastes.
30	0	,,	2-inch pipe in services.
208	0	,,	Ditto, in wastes.
342	0	,,	2½-inch pipe in wastes. One elbow to 2½-inch waste pipe.
71	3	,,	4-inch soldered socket pipe, made of 7-lb. lead to wastes, with strong joints, soldered, fixed complete. Two elbows extra.
1412	0	,,	5-inch ditto, made of 8-lb. lead, and ditto, ditto, for soil pipes to water-closets. Fifty-one elbows extra to this.

43 Bends and extra labour to 5-inch pipe, to pass over offsets from 2½ to 5 inches.

3 Pieces of 5-inch socket pipe, fixed and soldered to D traps, safes, and soil pipes.

53 Flanched joints, to connect lead and iron pipes, bolted.

Cocks fixed complete, all of the best quality, with screw bosses, lever handles, soldered joints to pipes.

46 ¾-inch, and 3 1-inch bib cocks.

38 ¾-inch, 18 1-inch, and 1 1½-inch stopcocks.

38 ¾-inch, and 17 1-inch cocks, with copper water-balls.

52 1½-inch, and 13 2-inch washers and wastes fixed to cisterns.

30 ¾-inch, and 21 1-inch ferrules and fees for laying on.

4 Brass unions to slate cisterns for ¾-inch pipes, fixed, complete.

9 Ditto, for 2-inch pipes.

4 Ditto, for ditto, to pumps.

4 Ends of 1-inch pipe casing over bolts, soldered to cistern sides.

46 4-inch brass grates and lead D traps fixed in sinks.

The contractor to execute in addition to all the foregoing, and to what is shown and has been described, extra plumber's work to be ordered by the architect to the extent in value as follows:—

	£	s.	d.
In Royal-Exchange Assurance offices ...	45	0	0
In London-Assurance offices	30	0	0
For the branch main in east area	25	0	0
In Lloyd's offices	150	0	0
In Banking-house	20	0	0
In water-closets and sinks for shops	45	0	0
In the unappropriated offices	20	0	0

Lay on water in four places, and pay for the use of water for all trades.

N.B. All prices and amounts given in this specification of plumber's work to be considered prime-cost prices and values.

To allow for ample and proper casing to protect all plumber's work, and for the preservation of it from injury by the workmen and others, delivering up all water-closets, urinals, sinks, cisterns, and all appurtenances, in clean and perfect condition.

All the plumber's work, when done, to be examined, and all works done beyond what is shown and described to be allowed as extra works, according to the conditions of the contract; all works not done in extent and in quantity, and all deficiency of quality, or value, as also all the sums of money, or parts of them, provided for extra works which the architect shall not order to be done, shall be deemed deductions, and shall be valued according to the conditions of the contract, and allowed by the contractor as offsets against allowed claims for extra works as far as their amounts will permit; and if the valuation should exceed the value of such extra claims, the balance to be deducted from the last payment on account of the contract to be paid to the contractor.

(To be continued.)

RAILWAY INTELLIGENCE.

GAUGE OF RAILWAYS IN AUSTRALIA AND THE COLONIES.—It has been determined, on the recommendation of the Railway Commissioners, to adopt the national, or narrow gauge, of 4 feet 8½ inches, for railways in the Australian colonies. The Commissioners, in their report to Lord Grey upon this subject, state that they believe the guage of 4 feet 8½ inches will be found sufficiently wide for all the requirements of newly-settled colonies for a long period, and that as the Australian colonies will, most probably, be for some time dependent on the mother country for the working stock of their railways, there will be an advantage in being able to order engines exactly similar to some of those in use in this country. They are of opinion, at the same time, that where it is necessary to provide for a large passenger traffic, and speed exceeding 40 miles an hour is to be obtained, the wider gauge, by allowing a greater evaporative power to be given to the engines, would afford an advantage. This was in reply to a proposal by Lord Grey for adopting the 5 feet 3 inches, or Irish gauge.

The North Kent Railway, to Woolwich and Gravesend, (joining the Rochester line), was opened on the 30th July. Railway communication from the metropolis to the important dockyards of Portsmouth, Plymouth, Chatham, Woolwich, and Deptford, is now established. An electric telegraph is to be placed on the North Kent line to communicate with Woolwich Dockyard and Arsenal.

ASSURANCE OF RAILWAY TRAVELLERS.—This new system of life assurance, in the event of railway accident, is now in operation over the London and North-Western and Lancashire and Yorkshire Railways. The assurance tickets for the single journey, irrespective of distance, are obtained at the same time that the passenger pays his fare and takes his ticket. The first-class passenger paying 3d., insures 1,000*l.*; the second-class paying 2d., 500*l.*; and the third-class passenger 1d., 200*l.*, the amount, in the event of loss of life, to be paid to their representatives; and they are entitled to compensation in cases of personal injury. It is understood that tickets will soon be procurable over the Lancaster and Carlisle, North British, Caledonian, Edinburgh and Glasgow, Chester and Holyhead, Eastern Counties, Cockermouth and Workington, Stockton and Hartlepool Railways; and that arrangements are in progress to afford the same accommodation to the travelling public on the other lines as speedily as posssble.

EXETER AND CREDITON.—The inhabitants of Exeter and Crediton have presented petitions to the Railway Commissioners, praying for the opening of this line, the present position of which is probably one of the most curious in the records of railway practice. Though completed three years ago, owing to disputes between the advocates of the broad and narrow gauge, it has never been opened for traffic. Grass, during this period, has grown over the entire route, and haymaking has been commenced in due season. The line, by Act of Parliament, was constructed on the broad gauge; but, subsequently, a majority of the shareholders determined on altering it to the narrow gauge, and obtained an injunction, still in force, from the Court of Chancery, which precluded the directors from opening the railway on any other plan than the narrow gauge—the cost of substituting which for the broad gauge is estimated at £1,400. The line is leased to the Bristol and Exeter at a rental of £3,000 per annum, and one-third of the gross receipts, above £7,000 per annum. The estimated net profit on the traffic is taken at £5,176, or equal to 8 per cent.

The Royal Railway Carriage, that has been built expressly to carry her Majesty on the Irish railways, is magnificently fitted up, and is said to have cost £5,000. It is of Irish manufacture.

NOVELTIES.

AMERICAN WHITEWASH.—Take half a bushel of good unslaked lime; slack it with boiling water, covering it during the process to keep in the steam. Strain the liquor through a fine sieve or strainer, and add to it a peck of clean salt, previously dissolved in warm water, three pounds of good rice, ground to a thin paste, and stirred while boiled hot; half a pound of powdered Spanish whiting, and a pound of clean glue, which has been previously dissolved by first soaking it well, and then hanging it over a slow fire in a small kettle within a large one filled with water. Add five gallons of hot water to the whole mixture; stir it well, and let it stand a few days, covered from dirt. It should be put on quite hot; for this purpose it can be kept in a kettle on a portable furnace. It is said that about one pint of this mixture will cover a square yard upon the outside of a house, if properly applied. Brushes, more or less small, may be used, according to the neatness of the job required. It retains its brilliancy for many years. There is nothing of the kind that will compare with it, either for inside or outside walls. Any required tinge can be given to the preparation by the addition of colouring matter.

INTERESTING AGRICULTURAL EXPERIMENT.—Some doubt having been entertained whether the maize plant, which grows almost spontaneously in tropical climates, could be successfully cultivated in this country, an experiment upon a small scale has been made within the ornamental enclosure in St. James's Park, by permission of the Commissioners of Woods and Forests. The seed was put in on the 24th of May last, and, though for some time retarded by easterly winds, the young shoots came up well. However, when the plants began to feel the cheering influences of light and air with a hotter sun, the success of the experiment was abundantly testified by the vigorous aspect of the little crop. It has been inspected by several gentlemen interested in agriculture, all of whom expressed their astonishment at the rapid progress made within forty-five days, the greater number of the plants having grown one inch every day since the present sultry weather set in. The spot selected was not favourable to the experiment, being close to a nursery of young trees and flowering shrubs, which in a great degree tended to deprive the plants of the benefits of light, sun, and air. It is calculated that 30 acres of maize would be worth £400, if the soil be of an average quality and properly drained. The cultivation of maize has been deemed of so much importance by the Council of the Royal Agricultural Society of England, that two very able papers have already been published in the society's journal, explanatory of the properties of this plant, and pointing out the best system of culture. Should the experiment now in course of trial in St. James's Park succeed to the extent predicted, it is presumed that it will be very generally adopted throughout the kingdom.—*Times.*

EXTRAORDINARY MEDAL.—A very curious medal in bronze has just been completed by M. Juavenel, a Belgian artist. The head of her Majesty, which is executed in a very bold style, is surrounded by the names of offices of the present Ministry, while on the reverse side appears the name of every member of the House of Commons for the year 1849.

PORTLAND BREAKWATER.—On the 25th ult., H.R.H. Prince Albert laid the first stone of the breakwater, which, when finished, will convert Portland Roads into a vast harbour of refuge. This plan was proposed many years back by Mr. Harvey, of Weymouth, and the subject has been followed up by his son and other public spirited gentlemen. It was not, however, until 1846 that the project was seriously taken up by Government, at which time the Refuge Harbour Commission reported very strongly in its favour. The work was not even then decided upon, until a second commission had confirmed and strengthened the recommendations of the first, when the design of the work was entrusted to Mr. Rendell, C.E. The situation of Portland Island with reference to the Channel Islands, the southern coast generally, and the admirable anchorage in the Roads, fully establish the importance of the undertaking, which, as planned by Mr. Rendell, will shelter an area of 1,822 acres from the only wind to which it is now exposed. The breakwater will run on from the eastern point of the island 1,500 feet in an easterly direction, and then going off at an angle, will be carried 6,000 feet to the north-east. At the angle there will be an opening of from 400 to 500 feet for the use of steamers and small craft; but the whole work will be 7,900 feet, or one mile four furlongs in length. Of this more than 7,000 feet will be built in from 5 to 8½ fathoms' depth at low water. Of the whole area there will be 1,544 acres, having not less than 5 fathoms' average depth, and 1,072 acres with 6½ fathoms' average depth, thus making accommodation of the most ample kind for the largest channel fleets. From the extraordinary facilities which the stone quarries on the island afford for the work, and the intended employment of convict labour for quarrying the stone and loading the waggons, the estimated cost is only £500,000.

KING LEOPOLD AND THE BOILER-MAKERS.—In the town of Lacken, in Belgium, a boiler-maker had established himself near the residence of the Burgomaster, whose morning slumbers and afternoon naps were sorely disturbed by the music of the rivetting hammers. Being "determined to put down this nuisance," he took advantage of the boiler-maker, not having received special permission to carry on such a business, to close and seal up the gates during the absence of the men. A row, of course, followed, and the men, finding they could make no impression on the Burgomaster, determined to appeal to the King. A petition was drawn up and signed, and they ~~started~~ for the palace where they were met by the military governor of the province, who, on learning their errand, took the petition to the King. One of the men was summoned into the royal presence, and told his story. The King replied—"My friend, this is not right on the part of the Burgomaster: he must be aware that I suffer great annoyance from the chymical manufactory of Mr. C., which is contiguous to my grounds. I cannot even walk in my garden when the wind is in a certain quarter. Surely, the Burgomaster can put up with the inconvenience of your shop, which, after all, is but a litte noise. I will see that justice is done." The next morning the shop was open, and, in the evening, the men serenaded the King, who gave them a good supper in return.—From the *Chronicle.*

STATISTICS OF METALLURGY.—Returns, obtained by Messrs. Pendarves and Evans, state that, in the year 1848, 3,788 tons of pig and sheet lead were imported into the United Kingdom, together with 1,298 tons of lead ore, and 64 tons of white lead. The total export of lead ore from the United Kingdom was 134 tons, of pig and rolled lead 4,977 tons, of white lead 1,168 tons, of red lead 842 tons, and of pig and sheet lead 3,747 tons. The quantity of copper ore imported, in 1848, amounted to 50,053 tons, and the value of the copper manufactures imported to £9,200. Of this copper the greater portion (30,679 tons) was imported fromCuba, and the rest, for the most part, from Australia, New South Wales, Chili, and Peru. The quantity of copper ore retained for domestic use was 51,307 tons, yielding a duty of £10,227 net. The total quantity of British copper exported amounted to 13,466 tons. The total export of British copper from the port of London, in 1848, amounted to 6,502 tons, and the total value of the copper manufactures exported from the same port to £5,989. The quantity of British copper exported from Liverpool, in 1849, amounted to 4,892 tons. The total imports of tin, in the year 1848, amounted to 298 tons, yielding a duty of £1,437. The exports of tin from this country amounted to 1,797 tons of British, and to 417 tons of foreign. The quantity of zinc or spelter imported, in 1849, was 13,529 tons, duty free. The quantity of zinc exported was 562 tons of British, and 3,766 tons of foreign.

ON THE PRESERVATION OF WATER, BY M. PERINET.—M. Perinet, ex-Professor of the Hospital Militaire d'Instruction, has succeeded in preserving water in a sweet state, by placing a kilogramme and-a-half of black oxide of manganese in each cask of water containing 250 litres. He has kept this water for seven years in the same barrels, and exposed them to various temperatures; at the end of that time, he found it as limpid, free from smell, and of as good a quality as at the beginning of the experiment.

The New Savings' Bank Bill.—In consequence of the late period of the session, and the press of other business, the Chancellor of the Exchequer recently announced that this important bill would not be brought forward until early next session. Government, we hear, will become responsible for sums only actually received by the treasurer of each savings' bank, and certified by him in the depositors' pass-books, and that no other person will be authorised to give a receipt on the part of the Government. For his trouble the treasurer will receive a fixed salary (say 50*l.* for a bank with 100,000*l.* capital), and not a quarter per cent. as previously announced. A manager is to be in attendance as usual to make out a list of the deposits or payments, as the case may be, from the depositors' pass-books, to be handed to him by the treasurer for that purpose, each book being then handed to the actuary, who will make the entry in the ledger account in the presence of the depositor. The treasurer and manager are both to certify to Government the total amount deposited or paid out. As no repayment will be made but by previous notice, the treasurer is to retain a sufficient sum only to provide against the next repayment day; all above that amount will have to be forwarded immediately to the Bank of England, to be placed to the account of the National Debt Commissioners. It is not clear at present that auditors will be appointed; but it will be proposed to reduce the Government rate of interest to 3*l.* 2s. 6d. per cent., and to allow a uniform rate of 2½ per cent., to depositors; also to reduce the maximum of balances to 100*l.*—*Reporter and Savings' Bank Advocate.*

Interesting Discovery.—M. Paul Gervais (says the *Constitutionnel*) has just discovered in the upper tertiary stratum of Montpellier a species of fossil ape, probably belonging to the *Macaque* genus. On comparing this discovery with that of M. Lartet in the Gers, and those made in the environs of London, it appears that fossil apes have been discovered in the three principal tertiary strata of western Europe—that is to say, in every part of the level of sedimentary earths in which the bones of mammalia abound. If man had existed at the period when these strata were deposited, the non-discovery hitherto of the slightest trace of human skeletons, or remains attesting human industry, would be very astounding. The discovery of these fossil apes is, therefore, an additional indirect proof of the very inferior antiquity of man on the earth.

On the Manufacture of Enamelled Copper at Canton.—When the copper has been shaped into the desired form, it is to be cleansed, but not scoured, and afterwards wetted with water, and sprinkled with the enamelling composition intended to form the ground, which may be either white or coloured. The article is then put into a muffle heated by means of dry Nankeen coal (this is found to be the best fuel). When the ground has been produced, the article is withdrawn from the muffle and covered with an iron bell, in order that it may cool slowly: the ground may be then ornamented in the same manner as porcelain, and again passed through the muffle. Several specimens of enamel, and colours upon enamel, have been deposited at the royal manufactory of Sevres, in order that the manufacturers in France may be made acquainted with the art.

Improved Method of Tempering Edge Tools.—For heating axes or other similar articles, a heating furnace is constructed, in the form of a vertical cylinder, the exterior made of sheet iron, lined with fire-brick, 4 ft. 8 in. diameter, or of such outside diameter as to give it an inside one of 4 ft., and 3 ft. high. In the interior of this cylinder, several fire chambers are formed—usually four. The inner wall of each fire chamber is 18 in. long, 4 in from front to back, and about 4 in. in depth; forming, in the whole, a circle of 3 ft. 4 in. diameter. Under each there are grate bars, and air is supplied through a pipe, connected with a blowing apparatus. A circular table of cast iron, 3 ft. 4 in. diameter, is made to revolve slowly on the level with the upper part of the said chambers. This chamber is sustained on a central shaft, which passes down through the furnace, and has its bearing in a step below it; a pulley keyed on to it serves to communicate rotatory motion to the table. When the axes or other articles are to be heated, they are placed upon the table, with their bits or steeled parts projecting so far over its edge as to bring them directly over the centre of the fire; and the table is kept slowly revolving during the whole time of heating. When duly heated, they are ready for the process of hardening. The hardening bath consists of a circular vat of salt water; within the tub or vat, a little above the surface of the liquid, is a wheel, mounted horizontally, with a number of hooks around the periphery, upon which the axes or other articles are suspended. The height of the hooks from the surface of the liquid is such as to allow the steeled part only to be immersed. As soon as the hardening is effected, the articles are removed from the hooks, and cooled by dipping in cold water. With the best cast steel, a temperature of 510° Fah. has been found to produce a good result, in hardening in about 45 minutes.—*Scientific American.*

A few days ago, Mr. S. Swain, engineer of the *Ethiopia* steamer, caught a young shark while amusing himself with fishing in the Nelson Dock at Liverpool. It measures about fourteen inches in length, and is considered a great curiosity, as fish of this species are rarely caught in these latitudes.

Expense of a Boundary Line.—The boundary line between the United States and Canada, run in accordance with the Ashburton Treaty, cost the labour of 300 men 18 months. For 300 miles a path was cut through the forest 30 feet wide, and cleared of all trees. At the end of every mile is a cast-iron pillar, painted white, square, four feet out of the ground, seven inches square at the bottom, and four inches at the top, with raised letters on its sides, naming the commissioners who run the line, and the date.—*Montreal Morning Courier.*

Excessive Heat.—On the 15th May, the thermometer stood at 181° on the drying terrace of the Gunpowder Manufactory at Madras, or only 31° short of the boiling point of water!

Increase of Insurances.—In 1821, the amount of property insured is stated at above 526 millions; in 1841, at above 682 millions; since when, it has increased in a similar ratio.

Stopping for the Teeth by M. Bernoth, of Warasdin.—Powdered mastic, 90 grammes; sulphuric ether, 40 grammes; digest for several days, strain it through a cloth, then add native alum in fine powder, in sufficient quantity to form a plastic mass, with which small phials, holding eight grammes, are to be filled, having first poured into each, camphorated alchol, two gramme, essence of cloves 1 gramme. This stopping introduced into the cavity of a carious tooth, first well cleaned and dried, is extremely useful, on account of the great degree of hardness it acquires.

Oxford Town Council.—Blind Tenders.—At the town council held a few days ago, the following fourteen tenders were opened for new water-wheels, pumping machinery, &c., at the City Water Works. Messrs. Easton and Amos, engineeers:—

Hunter and English, Bow, Middlesex	£670	0	0
Vulcan Foundry, Warrington	650	0	0
Winder and Co., Moreton-in-the-Marsh	602	0	0
Jukes and Co., London	593	19	6
Lampitt, Banbury	545	0	0
C. and W. Earl, Hull	541	9	0
Cochrane and Co., Dudley	530	0	0
Bearcroft and Co., Leeds	496	0	0
Loyd and Co., London	475	0	0
Sturge and Co. Bradford	470	6	2
Stobert and Co., Newark	460	0	0
Lee and Taylor, Oxford	450	0	0
Beaumont, Whitechapel, London	410	5	4
Butler and Co., Leeds	346	0	0

—*Builder.*

New Prussian Muskets.—These are known as "Zundnadelgewehre," from the explosion being produced by the passing of a pin through the cartridge. The barrels are rifled, and the bullets are *spitz kugeln*, a kind of conical bullet. They are conical at the point, cylindrical in the middle, and globular at the end. The cartridges in which these bullets are, have a layer of explosive mass next to the bullet, and the gunpowder is at the bottom of the cartridge, which is put in at the lower end of the barrel. On the trigger being pulled, a thin piece of steel (*nadel*) enters through a hole in the back of the barrel, and piercing the cartridge and the gunpowder, it proceeds to the explosive mass, which is similar to that in the ordinary percussion caps. The gunpowder is thus lighted at the front, and every grain of powder is consumed. The charge of powder is ⅛ of an ounce, while that of a percussion musket, is usually ¼ oz. These muskets enable a soldier to charge and fire six or eight times without lowering his musket, and 1,000 yards is still a good killing distance. It is not a safe distance for hitting, but 800 yards is; and a good shot is at that distance pretty sure of his aim. Eight hundred yards, then, is the range of these muskets, while the usual musket-range is 400 yards; and thus the enemy must advance 400 yards in the fire of the Pussian troops before they can think of returning it. A troop of soldiers marching in double quick time would make that distance in four minutes, and be exposed to from 25 to 30 shots from each Prussian musket. The cavalry, which wants 2½ minutes to advance 800 yards, is exposed to 20 shots from each man. As for the Artillery, their discharges of grape and canister tell fearfully at 400 yards, and have but small effect at 800. The Artillerymen are thus exposed to the Prussian muskets, and can be picked off as they stand by their pieces.

We are glad to see that the example recently set by the literary men of Belgium, is already beginning to communicate its wholesome infection. The Committee of the Society of Men of Letters in Paris has had a meeting to take the matter of the Belgian initiative and the subject in general under consideration; and has appointed a commission to put itself into communication with the Society of Inventors—who are banded for the defence of inventions against piracy—and in conjunction with them to make a careful inquiry into the whole subject.

The *Siecle* says that overtures have been made to the English Government for the establishment with France of a convention relative to patents, by which when patents should be taken out with certain formaliaies, they would be available in both countries.

THE ARTIZAN.

No. X.—Fourth Series—OCTOBER 1st, 1849.

MECHANICAL ENGINEERING.

CONSTRUCTION OF THE BRITANNIA AND CONWAY TUBULAR BRIDGES.

By W. Fairbairn.

(Continued from page 194).

The defective powers of resistance of all the tubes of this shape have suggested a new arrangement and distribution of the metals; it being evident from the experiments that the tube will resolve itself into a huge hollow beam or girder, leaving the two resisting forces of compression and extension as wide apart as possible. It is further conclusive, that the sides must be made comparatively light, and considerable additional material introduced into the top and bottom of the tube. This will give greatly increased strength, and a few more experiments will determine which of the two shall have the preponderance. It is more than probable that the bridge, in its full size, may take something of the following sectional shape (fig. 9). The parts *a*, *a*, being two longitudinal plates, divided by vertical plates so as to form squares, calculated to resist the crushing strain in the first instance, and the lower parts, *b*, *b*, also longitudinal plates, well connected with rivetted joints, and of considerable thickness to resist the tensile strain in the second; or it may resolve itself into something of this form (see fig. 10), with a series of tubes extending the whole length of the upper side, to resist compression, and two tubes with strong longitudinal plates, *c*, *c*, to resist tension, and prevent tearing in that part —the sides in this case to be made light, in order simply to connect the upper and lower resisting portions of the structure. From the above statement you will perceive that we are still short of the correct form. The experiments are progressively developing facts which I have no doubt will enable me, with the assistance of such an able experimenter and excellent mathematician as my friend Mr. Hodgkinson, to lay before you such results as will fully justify the adoption of this important structure. In the meanwhile I shall be glad to hear from you; and, requesting the favour of your opinion,

Fig. 9.

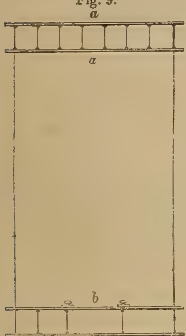


Fig. 10.

"'R. Stephenson, Esq., C.E. I am, &c., W. Fairbairn.

"'I have written the word "private" at the commencement of this letter, as it is merely written off-hand, in order to put you in possession of the progress we are making in these researches, without being pledged to facts. I should think another week's investigation, which I expect will take place in a fortnight, will enable me to speak more definitely.'

"The following letter from Mr. Hodgkinson explains his views respecting the experiments which had been made, and also gives his ideas as to the form of tubes and the experiments which he should recommend for trial. His suggestions were carried out, in accordance with the instructions sent to Millwall on October 2, but the experiments showed that the forms which he recommended were weak and unsatisfactorily.

"'Abersychan, September 26, 1845.—My dear Sir,—I have received your letter, with the remainder of the experiments, but what to do with them 1 am quite at a loss. I have no principles to guide me, satisfactory to my own mind, nor the aid from books, which I should have if I was at home. I have done my best to reduce some of the experiments; but the results are so much at variance that I am completely puzzled. What adds greatly to the difficulty is, their want of adaptation to mathematical requirements. 1 shall not have it in my power to leave this place before the end of next week, without doing the parties a great injustice, but will do all I can on my return. I have been very unwell since my return from London, in consequence of the cold I caught there. I mentioned to you before, that there are fundamental experiments necessary to make any useful application of these of yours; but while I am here I can do nothing, and before I should be at liberty to do anything but try to reduce the experiments made and suggest some modifications of them, it would be necessary to get the sanction of Mr. Stephenson, I suppose. Were I at liberty to make any experiments, I would begin with some cylinders as free from rivets as possible near to the middle, so that they should break in a part not rivetted. This might be done by taking long plates for the middle of the cylinder, and lengthening it out by small plates, since the rivets in them would not signify. I would have three cylinders made, all of the same diameter and length, say 18 or 20 in. diameter at the least, and the length 16 or 17 times the diameter. One of these cylinders should have its plates half an inch thick, and the others $\frac{1}{4}$th and $\frac{1}{8}$th of an inch. I would have them simple cylinders with one row of rivets on each side—none at the bottom or top near to the middle —nor any aperture made there for the shackle. A section of the cylinder would be as represented in fig. 11, where I would rather there were no rivets; but, as they cannot be avoided, they must be introduced. The

Fig. 11.

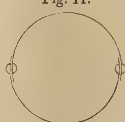
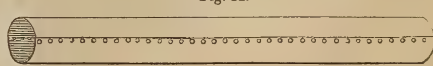


Fig. 12.



length of the cylinder would be as shown in fig. 12. I would have three other cylinders made, of half the diameter and length as the preceding one; and their plates should be of half the thickness as those above, say $\frac{1}{4}$th, $\frac{1}{8}$th, $\frac{1}{16}$th of an inch; these cylinders should be rivetted *on the side only*, as in the former case. If you think well to prepare these for me, I will make the experiments on my return to Manchester; and the results will throw a little light upon the subject and enable me to judge better of the anomalies in your tube experiments. There appears to me, however, to be a great want of fundamental information on the subject.

"'W. Fairbain, Esq. I am, &c., E. HODGKINSON.

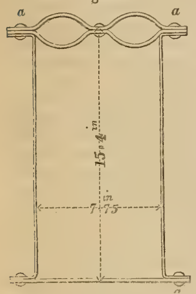
"'P. S. I am much in want of a book, "Navier's Application de Mécanique.' I have thought of sending home for it; but perhaps by the time it arrived I should be ready to return. I know there is something to my purpose in 'Navier.' You have the book likewise.'

"Mr. Hodgkinson did not experiment upon these tubes although they were constructed for him, since he found, from the experiments which had already been recorded, that the rectangular forms were decidedly the best; accordingly, the models subsequently made for him were of this form. The interval of time which ensued between the experiments on the rectangular and elliptical tubes with single cells, and those on the tube with a corrugated top, was chiefly occupied in preparing this latter tube for experiment. On the 14th of October it was subjected to the usual tests, as explained in the following letter addressed to Mr. Stephenson:—

"'Manchester, Oct. 15, 1845.—My Dear Sir,—Our experiments of yesterday were the best and most satisfactory we have yet made; and, agreeably to expectation, the form, as per annexed sketch, gave not only the greatest strength, but what was of equal importance, there was a near approximation to an equality of the forces on the top and bottom sides. The figure, you will observe, was in strict accordance with the views contained in my letter, which followed our previous efforts; the section being a rectangular figure, as above, with a double corrugated plate, each plate for the bottom being 0·18 inch. The sides were only 0·07 inch thick, and the whole rivetted together, as at *a, a, a, a*. With this form of tube (19 ft. distant between the supports) the deflections were carefully taken at intervals, from weights of about 1,800 lb.; and before the tube gave way, which it did by tearing the sides from the top and bottom, it sustained for some minutes a weight of 22,469 lb. From this last experiment it is evident we are approaching the strongest form; but we are still in want of further investigation, in order to obtain a correct and satisfactory formula for the reduction of the experiments. Some existing formulæ of 'Navier' and others can be applied, but they are not satisfactory; and before my friend Mr. Hodgkinson can satisfy himself on the mathematical part of the case, some further experiments must be made on *exceedingly small* and *greatly enlarged tubes*, with certain functions, calculated to establish the law which governs, not only the strength of the present but of all future forms of tubes. This will, however, not create any delay, as I have ordered the plates, and I shall have the tube constructed forthwith, the experiments being made here in Manchester, on account of the more powerful apparatus which we have at command. In the meantime, I think we have sufficient data to guide you as to the security of such a structure; and provided you will fix time and place where we can meet, I shall lay before you such information as will, I trust, justify the measures you intended to adopt. Any day after next Tuesday I could meet you in London or elsewere. I am, &c., W. FAIRBAIRN.

"'R. Stephenson, Esq."'

Fig. 13.



"It is from this period (says Mr. Fairbairn) that I date the disappearance of almost every difficulty respecting the construction and ultimate formation of the Britannia and Conway tubes. The powerful resistance offered to compression by the cellular form of top, as exhibited in the last experiment, at once decided, in my mind, the form to be adopted in those for the large tubes, and from this time forward I had no doubts as to the practicability and complete success of the undertaking."

The great point, now, was to deduce a formula which could be applied to the designing of the large tubes, and the experiments of Mr. Eaton Hodgkinson were more particularly directed to that object. On February 9th, 1846, Mr. Stephenson presented his report to the Chester and Holyhead Railway Company, in conjunction with reports by Mr. Fairbairn and Mr. Hodgkinson. In this report Mr. Stephenson avoids committing himself to any definite opinion on the subject of the suspension chains; Mr. Hodgkinson recommends that suspension chains be employed as an auxiliary, as otherwise great thickness of metal would be required to produce adequate stiffness and strength. Mr. Fairbairn states that, "provided the parts are well proportioned, and the plates properly rivetted, you may strip off the chains, and leave it as a useful monument of the enterprise and energy of the age in which it was constructed.

Mr. Hodgkinson appears to have had so much difficulty in satisfying himself as to the proper form to be adopted, and the directors to have become so impatient at the delay which had already taken place, that Mr. Fairbairn proceeded to work the problem out for himself. A model, one-sixth of the real size, was made, with square cells, and, after several experiments, the following formula was deduced, which Mr. Fairbairn states to be that now employed for his patent girders.

Let W = breaking weight; l, the distance between the supports, in inches; a, the area of the bottom side, in inches; d = the whole depth of the beam in inches; then,

$$W = \frac{80\ a\ d}{l} \text{ tons}$$

The following table of experiments on the large model tube, one-sixth of the real size, shows how the strength of the cellular top resisted all attempts to crush it until the last trial, the strength of the bottom being increased at each trial. This tube was 78 feet long, and 75 feet between the supports; 4 feet 6 inches deep, and 2 feet 11 inches wide.

No. of Experi-ments.	Thickness of Plate in inches.		Breaking Weight.	Remarks.
	Top. Area.	Bottom. Area.	lbs.	
1	24.02	8.80	79,578	Broke by tension.
2	...	12.80	97,102	Twisted over.
3	...	12.80	126,128	By tension.
4	...	17.80	148,129	By tension. [on its side.
5	...	22.45	129,009	Weight left suspended. Tube turned
6	...	...	26,781	Experiment discontinued.
7	...	22.45	135,255	Weight left suspended for 9 days.
8	...	22.45	135,255	Broke by tension.
9	...	22.45	154,452	Broke by tension.
10	...	22.45	192,892	Crushed on the top.

The first of the Conway tubes was tested, and gave the following results:—Rectangular tube, 412 feet long, 25 feet 6 inches deep in the middle, 15 feet wide, and 400 feet between the supports. Area of the top, 670 inches, ditto of bottom, 517 inches. Computed weight of tube, including rails and cast iron frames at the ends, 1300 tons.

No. of Experi-ments.	Deflection.	Weight.	Remarks.
	Inches.	Tons	
1	7.91	0	The weight of the tube, 1300 tons, gave a deflection
2	9.02	95	of nearly 8 inches, and 95 tons left in the inside of
3	9.50	154	the tube for 4 hours increased the deflection from
4	10.50	201	9.02 to 9.25. This weight was continued for 17
5	10.95	301	hours, with an increase of deflection .1 inch.

After this, 301 tons, exclusive of the weight of the tube, were laid on, when the experiment was discontinued. The first weight, 95 tons, was spread over a surface of 70 feet in length of the tube in the middle; the second weight was laid over a surface of 105 feet in the middle; the third over a surface of 150 feet in the middle; the last over a surface of 190 feet in the middle.

APPOLD'S CENTRIFUGAL PUMP.

We have had the pleasure of inspecting the working of a centrifugal pump, the invention of Mr. George Appold, which promises to be of especial value for draining marshes, and for similar purposes, where large quantities of water are required to be raised a small height.

The pump consists of two discs, connected by curved floats, and the water is admitted through the centre, and delivered at the circumference. The dimensions of the one we saw at work are—diameter, 12 inches; width, 3 inches; contents, one gallon. At a speed of 535 revolutions per minute, this mere bandbox of an affair raises 1400 gallons of water 5 feet 6 inches high per minute, with a duty of 76.1 per cent., taken by dynamometer. This appears the most advantageous speed, for on increasing it to 607 revolutions per minute, although the work is increased to 1800 gallons, yet the duty is diminished to 72 5 per cent.

The economy of first cost of this pump, compared with either plunger pumps or scoop wheels, renders it a subject of great importance, and it is one with which our readers cannot be unacquainted, since our pages have contained various papers on experiments by Mr. Whitelaw on his centrifugal pump, carried out with great minuteness and care.

REPORT OF THE COMMISSIONER OF PATENTS, TO THE SENATE OF THE UNITED STATES, ON THE SUBJECT OF STEAM BOILER EXPLOSIONS.

Ordered to be Printed January 24th, 1849.

On the 24th January, 1848, the Senate of the United States adopted the following resolution, of which the present report is the result.

"*Resolved*, That the Commissioner of Patents be directed to report to the Senate such information as he may have in his possession, or may obtain, that he deems important, with reference to further legislation by Congress for the prevention of the explosion of steam boilers, used in boats or for engines on railroads, and whether any amendments to the patent laws are advisable in effecting such object."

The length of this Report precludes our giving it entire, but as the facts contained in it, are such as are not generally accessible to our readers, we shall make some extracts, and a few remarks on them as we proceed.

"The resolution of the Senate embraces two calls: first, for information deemed important with reference to the prevention of boiler explosions; and, second, for the opinion of the undersigned as to whether 'any amendments to the patent laws are deemed advisable in effecting such object.' With regard to the second point of inquiry, the undersigned has no hesitation in expressing his belief that no modifications of the patent laws would have any tendency to lessen the evils which it is the object of the proposed legislation to mitigate.

"In order to comply as fully as possible with the requirements of the resolution, a circular was issued by this office on the 7th of March, 1848, addressed to the collectors of every port in the United States. Replies were received from sixty-eight collectors, as well as numerous communications from other sources, with reference to the subject of explosions.

The returns received enumerate two hundred and thirty-three explosions of steamboat boilers, from which accidents the number killed (as given in in one hundred and sixty-four cases) is eighteen hundred and five; making an average of eleven for each accident. If the sixty-nine cases in which the number killed is not stated average the same, the total loss of life, in the two hundred and thirty-three cases, would amount to two thousand five hundred and sixty-three.

"The number wounded, in one hundred and eleven cases, is one thousand and fifteen—an average of nine. The same calculation as in the former case would give as the total number wounded, two thousand and ninety-seven; making the whole number of sufferers, four thousand six hundred and sixty.

"The amount of pecuniary loss sustained in seventy-five cases is nine hundred and ninety-seven thousand six hundred and fifty dollars—giving an average loss of thirteen thousand three hundred and two dollars by each explosion; which, applied to the whole number of cases, would make the entire loss three millions ninety-nine thousand three hundred and sixty-six dollars.

"Of the explosions enumerated, two hundred and two, or .867 per cent., occurred on the southern and western waters; one hundred and forty-six, or .626 per cent. on the Mississippi river and its tributaries; ninety, or .386 per cent., on the Mississippi alone; forty, or .172 per cent. on the Ohio.

"From 1830 to the present time the number of explosions given is 198; making an average of ten each year, with 110 as the average annual loss of life, and ninety the annual average of wounded; the total number of sufferers, annually, being two hundred; and the annual pecuniary loss one hundred and thirty-three thousand and twenty dollars.

"The steamboat tonnage of the western rivers in 1846, was 249,055; and the whole value of the commerce of these boats 62,206,719 dollars. The probable extent in miles of the steam navigation of the western waters, as estimated by Colonel Long, of the topographical engineers, is sixteen thousand six hundred and seventy-four. The whole number of steam vessels built in the United States from 1830 to 1847, inclusive, is nineteen hundred and fifteen. The losses by explosion during the same period amount, according to the returns furnished, to one hundred and ninety-eight, or about ten per cent.

"The fact that the steam engine has come into such general use, and has been placed under the management of men widely differing in their education and judgment, and many of them entirely destitute of scientific knowledge, has given rise to a great variety of hypotheses designed to account for the explosions of steam boilers. Most of them have been mere crude speculations, without any foundation in fact or in physical analogy. Such are the pretended explanations which refer the explosion to the presence of electricity or the generation of hydrogen gas, and its union in explosive proportion with oxygen within the boiler. Of the former hypothesis, it is only necessary to say that electricity, if present at all, would reside on the *outside* of the boiler; and of the latter, that the necessary conditions are not present which would render it probable. In the ordinary condition of a boiler, no hydrogen is produced; and if it were present, it could not procure a sufficient supply of oxygen to combine with it in explosive proportion.

"Another hypothesis accounts for the explosion in this way: the water falling below the fire line in the boiler, the portion of the latter thus exposed, becomes excessively heated, and communicates its heat to the steam, which thus becomes *surcharged* with heat. Now steam, when heated separately from the water which generates it, follows the law which regulates the expansion of ordinary gases, *i. e.*, it expands $\frac{1}{480}$ part of its bulk (or nearly) for every degree of Fahrenheit above the freezing point. The increase of elastic force is therefore, under these circumstances, very small in proportion to the increase of temperature. But while the steam is thus *surcharged*, a supply of water is sent into the boiler, the surcharged steam at once becomes converted into *saturated* steam of high elastic power, and an explosion follows. This hypothesis, although ingenious, and long received as the true explanation of the phenomenon, is found to be contradicted by the results of careful and repeated experiments. The committee of the Franklin Institute, 'appointed to examine into the causes of the explosions of the boilers used on board of steamboats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects,' to whose valuable labours, which have thrown great light upon this whole subject, frequent reference will be made in this report, made a series of experiments in the prosecution of one point of their inquiries, to 'ascertain whether intensely heated and unsaturated steam can, by the projection of water into it, produce highly elastic vapour,' and satisfied themselves that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse; and, in general, that the greater quantity thus introduced, the more considerable was the diminution in the elasticity of the steam.

"A fourth hypothesis has been advanced in a communication to this office, from Mr. N. Sawyer, mechanical engineer of Baltimore, which may perhaps deserve the test of experiment. It supposes the water in a steam boiler to be permanently thrown out of level by the unequal pressure on its surface, resulting from the escape of the steam through the throttle valve and at one end, and the consequent diminution of pressure at that point. This alteration of level, of course, exposes a portion of the boiler to become unduly heated, and when the working of the engine is stopped, the restoration of level by gravity brings a quantity of water in contact with the overheated metal, producing highly elastic steam, which, according to the author, may result in an explosion. The existence of the difference of level, here supposed, is supported by the testimony of Mr. C. Evans, who remarks, in an article on the causes of explosion, that 'wherever the steam is taken from to supply the engine, there will be the greatest ebullition, and the water will be higher there than in any other part of the boiler.' The Franklin committee, in their experiments to ascertain 'whether, on relieving water, heated to or above the boiling point, from pressure, any commotion is produced in the fluid,' found that, 'on making an opening in the boiler, even when the pressure did not exceed two atmospheres, *a local*

foaming commenced at the *point of escape*, followed soon by a general foaming throughout the boiler, more violent in proportion as the opening was increased.' Though the difference of level, thus produced, could not it is believed, be sufficient to account for the production of a quantity of steam great enough to result in an explosion, yet the extent to which it would operate could be determined only by experiment.

"An hypothesis which has been lately advanced and to which the attention of Congress has been asked, in a published letter from its author, addressed to the honorable John Davis, of the Senate, would not have been noticed here but for the latter circumstance. This explanation of explosion, so far as it can be gathered from the pamphlet in which it is set forth, attributes the phenomena to the action of liberated caloric, set free by relieving the pressure under which its combination with water is stated to be alone possible. This hypothesis seems to have been suggested by the supposed impossibility of accounting for the phenomena of explosion from the gradually increased elasticity of steam by heat. That a gradual increase of pressure can produce all the effects of the most violent explosions, has been conclusively proved by the experiments of the committee of the Franklin Institute; in which it was shown that the very effects which, in the pamphlet alluded to, are considered impossible to arise from such a cause, did actually follow the gradually increased tension of the steam. The existence of one sufficient cause, fully supported by the experiments of men so distinguished for scientific ability as were the members of that committee, renders unnecessary a resort to vague hypotheses, unfortified by facts, having no foundation in physical analogy, and, as in the present case, based upon an assumption in contradiction of a well known physical law. Such hypotheses can only serve to divert the minds of practical men from the true causes of these fatal disasters, and thus still farther to embarrass the question of their proper remedy.

"The subject of deposits, in connexion with the over-heating of the metal of the boiler, is one of great importance, and one which is still comparatively open as a field of research. The Franklin committee made it one point of their inquiry to ascertain by experiment the effect of deposits in boilers. They admitted the collection and hardening of such deposits on the bottom of the boiler, and attributed the danger from them to the production of exfoliations of oxide, which gradually reduced the thickness of the metal, or to the weakening increase of temperature in the metal which they permit.

"With regard to incrustations and deposits in the interior of steam boilers, it may in general be admitted that these must differ with the character of the water used. In boilers using 'hard' water, they consist chiefly of the carbonates of lime and iron mixed with oxide of iron; containing, besides, the earthy salts from the water. Boilers using ocean water are found to detect the differences existing in different parts of the ocean in regard to the composition of its water. It appears that certain 'scales,' which were taken from the boilers of the United States' steamer *Marcy*, and subjected to analysis by Professor Johnson, were found to collect in the boilers while running over the Bahama banks; and the experience of the *Marcy* is confirmed by that of other steamers which have traversed the same tract of the Atlantic. Professor Johnson's analysis showed this salt to be di-hydrated gypsum, and led him to the application of the acetate of potassa as a solvent.

"The introduction of oil or fat into a boiler may result in the production of another class of deposits entirely different from the scales above alluded to, and which appear to result from a combination of fatty materials with earthy bases. Such an incrustation was found in the interior of a steam boiler at Burlington, N. J., and was submitted to examination by Professor Johnson, who supposes it to be a species of soap, formed between the earthy oxides and the acids of animal fat.

"In streams which, like the Mississippi and its tributaries, flow for thousands of miles through an alluvial country, and which are subject to freshets, not unfrequently producing alterations in depth of from thirty to fifty feet, the quantity of earthy, calcareous, and other matters held in suspension is great, almost beyond conception. Mr. Cist gives the estimate of an intelligent engineer, that in a twelve days' trip on the Mississippi, the quantity of mud injected into the boiler was fifty-one thousand six hundred gallons by measurement, or over two hundred tons in weight. This calculation is based upon the supposition that the sediment in the water amounted to ten per cent., a rate said to be below the fact, at least as regards the Mississippi. This sediment collecting on the bottom of a boiler, becomes, owing to the admixture of calcareous matter with the mud of which it is chiefly composed, hardened by heat to such a degree that very often it can be removed only by the use of a chisel and mallet. Thus hardened, it is liable to crack from unequal expansion, or other cause, when it admits water to come in contact with the overheated and softened metal below. The necessity for constant attention to the condition of the boilers with reference to this matter is sufficiently obvious. The deposits from salt and chalybeate waters are not less dangerous.

"The causes of unduly heated metal within a boiler usually operating are, no doubt, those which have just been described; yet the Franklin committee were induced, from the evidence before them, to admit the possibility of the metal of a boiler becoming unduly heated, even when in contact with water. The occurrence of such a fact, however, is extremely rare.

"About one-third of the cases reported in the returns are attributed to '*defective construction of the boiler and its appendages.*' These defects may be reduced to three classes—1, defects in the form of the boiler; 2, the use of improper or defective materials; 3, bad workmanship. The first class is not noticed as a cause of explosion in the returns to this office. In the second are embraced fifteen cases; in the last, eight. In eleven others, the particular nature of the defect is not stated.

"That the influence of form upon the strength of a boiler must be very great is obvious. The forms most commonly employed are, the waggon boiler of Watt, and the cylindrical boiler, either with or without flues. The boiler of Watt is only adapted to very low steam. Of cylindrical boilers, those without flues are most safe—those with flues have the advantage of economising fuel. Those flues which pass through both heads of the boiler are considered the most safe. Boilers containing small tubes have not been found successful.

"The connected boilers which are used on our western boats are incident to a peculiar source of danger: a mere change of position may be the cause of an explosion. The connecting water pipe is at the bottom of the boilers. When the boat careens, the water descends, of course, to the lower boiler, and leaves the higher ones exposed, in a greater or less degree, to the action of the fire while uncovered by water. The danger from such an exposure has already been pointed out. The use of connected boilers, in the opinion of the Franklin committee, ought to be discontinued.

"Boilers with L flues are liable to a similar source of danger. The portion of the flue above the level of the water in the boiler is exposed to the heat of the fire while not in contact with water. Its tenacity is thus diminished, and it is rendered likely to yield to the pressure within the boiler, and collapse.

"Boilers with steam chimneys are still employed for the sake of the advantage of having the steam surcharged with heat, so as to prevent condensation in the steam-pipe and cylinder. They differ from those last mentioned only in the fact that the exposure is greater. The source of danger is the same. Two explosions of boilers of this kind, examined by Mr. Ewbank, were identical in the phenomena exhibited. The vertical arm of the L flue, in both cases, was collapsed in the same way, showing that the defec is inherent in the form. The Franklin committee recommend the discontinuance of the use of both of these forms.

"They also discourage the formation of small spaces to contain water and be surrounded by fire. Such spaces are liable to accumulate deposits, and to become unduly heated by the water being forced out of them by the formation of steam, as in the case of small tubes.

"Boilers of irregular forms are necessarily weak; the tendency of a force acting within them equally in all directions would be to bring them to a cylindrical or spherical form.

"The use of cast iron as a material for boilers is believed to have been entirely abandoned; but five cases are given in which this material was employed for the *heads* of boilers which exploded; and its use for boiler heads is still, to some extent, persevered in, notwithstanding the warning voice which science and experience have united to raise against it. The question of the safety of the employment of this material for boilers came up before the committee of the British parliament, who were charged with the investigation of the causes of explosions in the year 1817; and the testimony against its use, even at that early period in the history of steam navigation, was unequivocal. The use of boilers, or boiler-tubes of cast iron, was positively prohibited by the French government in 1828. The operation of casting, however well performed, is an uncertain process; and the defects of structure incident to it, being concealed from view, lead to a false impression of the real strength of the article cast. But, perhaps, a more pregnant source of danger in the case of cast iron heads lies in the unequal rate of its expansion as compared with the wrought metal to which it is attached, rendering it constantly liable to fracture or cracking. Mr. Cist, in his valuable communication, mentions a case in which the cast iron heads of a range of seven boilers were all found in pieces when the boilers were taken apart at the head, and remarks that these heads are generally found in this condition when they are removed from the boilers. The history of six boilers of this kind, which were made at Shippingport, affords a striking proof of the danger arising from the use of such heads. Of these boilers one was placed on the *Car of Commerce*, and, although the only new boiler on the boat, it was the only one that gave way. Its after head was blown out, and the boiler was projected several hundred feet over the bows of the boat into the river. The five others were put into the *Atlas*, and exploded the same season in a similar manner. The case of the *Helen McGregor* was of the same character. The head of that boat's boiler blew out and broke into numerous small fragments, killing several persons and wounding others. Every consideration, then, of prudence, and even of common humanity, would seem to dictate the immediate and total abandonment of cast iron as a material for boiler heads.

"The causes of boiler explosions having thus been briefly considered, the

remedies which have thus far been proposed, suggest themselves as the next topic for consideration. These are either mechanical or legal.

"The various contrivances to prevent explosions by mechanical means are known as the "safety apparatus" of the engine. These contrivances have been well classified as being, first, such as merely indicate danger without relieving it; second, such as are brought into action and relieve the boiler from excess of steam by the force of pressure alone, or by temperature independent of pressure; third, such as are brought into action by deficiency of water, combined with pressure; fourth, such as supply water without indicating either pressure or temperature.

"To the first class belong the common syphon gauge of low pressure boilers; the manometer for high pressure boilers; the glass water gauge; the compound water gauge, or altometer, of Mr. Quinby; his alarm altometer and vaporimeter; the percussion water gauge of Worthington and Baker, together with the common try cocks, and all those instruments which depend on the opening of small valves to sound an alarm.

"In the second class may be placed the common safety valve, the safety guard of Mr. Evans, the fusible discs used in France, and the expansion guard of Mr. Wright.

"In the third class are to be found the safety apparatus of Mr. Raub, the hydrostatic valve of Mr. Duff, and the interior safety valve of Mr. Easton.

"To the fourth class belong the ordinary force pump, the subsidiary pumping engine used in many steam-boats, and the self-acting pumping engine of Mr. Barnum.

"The *vaporimeter* of Mr. Quinby is an instrument intended to indicate the temperature of the steam within the boiler by the expansion and contraction of mercury contained in a large metallic tube inserted into the boiler above the water level. It is, in fact, a large metallic thermometer, the bulb of which is the large tube within the boiler, and its stem the small perpendicular tube on the outside of it. On the mercury in this outer tube is placed a float connected with a rod, the varying height of which indicates the temperature of the steam, and its consequent elasticity. Its advantages are its little liability to injury from accident, and the ease with which its indications are read off, owing to the large size of the degrees marked upon its scale. It is however, a mere indicator of temperature, and the consequent pressure, dependent for its utility upon the watchfulness of the engineer, and, therefore, least useful where danger, from his neglect, is greatest. Its cost is also a serious objection.

"The *alarm altometer* of Mr. Quinby consists of a bucket float, enclosed in a cylinder connected with the boiler by lateral pipes entering below and above the water line, so that the water in the cylinder and in the boiler shall always stand at the same height. The fall of the float opens a small valve, to which a steam whistle is attached. The operation of this instrument, as reported by Messrs. Johnson and Jones, was not satisfactory. The alarm was feeble, owing to the smallness of the valve, yet its size, if increased, would enable the pressure upon it by highly elastic steam to counteract the weight of the float, and thus prevent any action. It is also liable to obstruction from deposits, is too complex in its construction, and attains no object that could not be secured by a float within the boiler.

"Another *altometer* has been invented by Mr. Quinby, which is a complex modification of the glass tube gauge, identical in principle, and offering no advantage over it. It is heavier than the common gauge, more liable to fracture, more difficult to repair, requires great precision in its workmanship, and is consequently very costly.

"The *percussion water gauge* of Worthington and Baker, is an ingenious contrivance for ascertaining the height of water in the boiler by the percussive action of a horizontal flat surface brought suddenly into contact with the surface of the water, the height of which is to be gauged. It consists of a tube so connected with the boiler as that the water it contains shall stand at the same height as that in the boiler. In this tube is a piston which can be brought into sudden contact with the surface of the water by means of a projecting arm, under the control of the engineer. When it is desired to ascertain the height of the water, the engineer, by means of the arm mentioned, pushes down the piston until it strikes the water: the slight shock or concussion produced by the contact is readily felt by the hand of the engineer, and the position of the arm at the time gives, on an attached scale, the desired information. This instrument is said to operate well, but it depends entirely upon the attention of the engineer, and neither indicates the approach of danger, nor relieves it. In the case of recklessness or neglect, it would be of no service.

"The *fusible plates* required to be attached to every boiler, by the ordinance of the French government, are plugs of an alloy so compounded as to melt, and so give vent to the steam, at a temperature corresponding with the greatest pressure under which the boilers are allowed to work. To prevent their giving way as they approach the fusing point, they are covered by wire gratings or perforated metallic discs. The experiments upon these plates made by the Franklin committee, show that when fusible alloys are subjected to heat and pressure at the same time, the more fusible portions are melted first, and forced out by the pressure to which they are subjected. The residuary mass is thus left with a fusing point much above that at which the alloy was calculated to melt. Every repetition of the fusing process under these circumstances was attended with a rise of the temperature required to produce the result. It is evident that the protection afforded by fusible plates, used in this way, diminishes in proportion as the necessity for it is increasing by the deterioration of the boiler from age and use. The liability to this action has been considered a sufficient reason for deciding that no efficient practical application of these alloys can be made while they continue to be subjected to pressure.

"To obviate this difficulty Professor Bache devised the plan of enclosing the fusible metal in a tube inserted into the boiler, thus subjecting it to the action of temperature alone. The melting of the alloy in the bottom of this tube sets free a rod connected with an alarm apparatus, and, if necessary, with the safety valve. The same idea occurred, about the same time, to Mr. C. Evans, of Pittsburgh, Pennsylvania, whose safety guard is identical in principle with the device of Dr. Bache.

"The *safety guard* of Mr. Evans consists of a tube inserted through the top of the boiler, with its bottom resting on one of the flues. A small quantity of fusible alloy is placed in the bottom of the tube, in which a spindle is inserted, so arranged as to be capable of turning only when the metal is in a state of fusion. On the upper end of this spindle is a small drum, around which a cord is wound. This cord passes over a pulley attached to the end of the lever of the safety valve, and has fastened to it the weight which keeps the valve down. The operation is simple; the alloy being melted, the spindle is, as it were, unsoldered, and allowed to turn; the cord is unwound from its drum; the weight falls on to a support prepared to receive it, and the safety valve is entirely relieved. The advantages of this plan are, that it not only indicates danger, but relieves it, and that the spindle is self-adjusting. The only operation requiring the attention of the engineer is the re-winding of the cord, an operation which could not be neglected without stopping the engine. The apparatus, however, is as liable to be tampered with as the common safety valve; it is acted upon by temperature alone, and would not indicate a deficiency of water, unless such deficiency were occasioned or accompanied by a rise of temperature sufficient to melt the alloy. The range of temperature in fusible alloys, between perfect fluidity and perfect hardness, is an important consideration with reference to the comparative sluggishness of the apparatus in which they are employed. The property most desirable in alloys, used in the safety apparatus of engines, is of course a small range of temperature in changing from the liquid to the solid state, as the promptness of the apparatus depends upon this quality. The Franklin committee found that, with reference to this range, those alloys should be preferred which contain the smallest quantities of lead; and, for the same reason, those containing the smallest proportions of bismuth.

"The comparative sluggishness depends so much upon the particular composition of each alloy, that no satisfactory general conclusion can perhaps be drawn from an average result. Alloys compounded to melt at high temperatures (where, of course, the necessity for promptness is greatest) have fortunately a less extensive range between fluidity and hardness, than those intended to give way at low temperatures. The average result obtained by Professor Johnson, from experiments on one hundred and forty specimens, makes this range 31.1 degrees Fahrenheit; so that when a mass of such alloy has become perfectly fluid, it requires that a number of degrees of heat to be abstracted before it becomes again perfectly hard. This whole difference, however, is not operative in practice in the case of Evans's apparatus; for it was found, by the commission of 1843-4, that the average difference of temperature between fusing and setting is only about seven or eight degrees, showing that the action of the weight upon the spindle causes it to turn before the alloy has become perfectly fluid, and that the alloy is sufficiently set to support the weight before it has become perfectly hard. Still a range of seven or eight degrees in a boiler, under a pressure of five or six atmospheres, would require the pressure to be diminished from two to two and a half atmospheres, after the action of the apparatus, before it would be again ready to act. This diminution would be attended with a loss of both water and heat. The range of temperature between the opening and closing of a common safety valve, in ordinary working order, was found, in the same research, to be about 5°, showing a difference in favour of the valve, of about 3°. The comparison, however, is not intended to be carried farther than this single point. The fusing point of the alloy does not change materially by the repetition of the melting process. On the whole, Mr. Evans's apparatus, when the alloy is properly prepared, the apparatus fairly used and not tampered with, is one upon which considerable reliance may be placed for the purpose which it professes to accomplish—the indication and relief of a dangerous elevation of temperature in the metal of the boiler.

"The *expansion guard* of Mr. Wright, makes use of the different expansibility of metals as an indication of the temperature of the boiler, and a means of relieving the safety valve, where the elevation of temperature is such as to indicate a dangerous increase of pressure. A brass tube, closed at its inner end, is inserted into the boiler head, immediately over one of the flues. In this tube, but lying loosely, and attached only to its inner end, is a rod of iron, projecting on the outside a short distance beyond the head of the boiler. When the brass tube is heated, it expands, and of course projects further into the boiler, carrying with it the less expansible iron rod. The outer end of this rod moves an index which shows the temperature of the

metals, and is attached to a catch which operates to relieve the safety valve, as soon as a dangerous pressure on the boiler is indicated by the temperature attained.

"With regard to all self-acting apparatus intended to relieve the safety valve, it ought to be borne in mind that their operation is attended with a consequence which might, under some circumstances, prove a very serious disadvantage. It is, that the boat may be deserted by its power at the moment of greatest need. In going through such a passage as "Hell Gate," for instance, such a desertion, even if but momentary, might be attended with fatal results. This view would seem to justify a preference for apparatus intended to give an alarm, over those which operate spontaneously to relieve the safety valve. Where engineers are careful, there can be little doubt of the propriety of such a preference.

"The third class of safety apparatus includes such as act by deficiency of water, combined with the pressure, to relieve from the dangerous tension of steam.

"The *double acting safety valve* of Mr. Raub differs from the ordinary safety valve in having a float and additional lever attached to it, so arranged that the fall of the float below the proper water line opens first a small valve to sound an alarm, and, if the fall continues, raises the main safety valve. The small valve opens downwards, and it was found that, in boilers using high steam, the pressure was sufficient to keep it closed, thus reducing the apparatus to the common safety valve, "to which," in the opinion of the board to whom it was submitted, "it is in no respect superior."

"The *hydrostatic safety apparatus* of Mr. Duff, is a valve with a large hollow head, from which a tube passes down below the ordinary level of the water in the boiler, to the lowest permissible water line. So long as the mouth of the tube remains below the water, the valve head is kept full of water, which thus forms the greater part of the load; but when the water in the boiler falls below the mouth of the tube, that in the valve head is, of course, discharged into the boiler, thus relieving the valve of its load. The time taken to discharge the water from the valve head renders the operation of this apparatus sluggish; and as it is liable to be brought into action by any sudden change of level in the water, though such change may be unattended with danger, it is not considered applicable to the boilers of steam boats.

"The *interior safety valve* of Mr. Easton is placed, as its name imports, entirely within the boiler, and is not liable to be tampered with by the engineer while the boat is in motion. The valve opens downwards, and is kept closed by a lever of the first order. There is a float attached, the fall of which raises the long arm of the lever and opens the valve. A rod, (called a *feeler*,) passing through the top of the boiler immediately over the valve, enables the engineer to open but not to close it. The valve was found upon experiment to open promptly, the mean difference between the opening and closing pressure being only 5.32 pounds. This apparatus, however, does not indicate whether the escape of steam is due to the fall of the water in the boiler, or to a pressure beyond its load. This may be ascertained, however, by raising another valve when, if the opening of the interior valve be caused by excessive pressure, it will at once close, but if from deficiency of water, it will continue to blow. Mr. Easton's apparatus is favourably spoken of by the board by whom it was examined. It was tried by them, however, under favourable circumstances, and with pure water. Its efficiency on the muddy waters of the west, this office has no means of ascertaining.

"The several forms of apparatus for supplying water, without indicating either temperature or pressure, constitute the fourth and last class.

"The instrument for this purpose, ordinarily employed, is the common force pump worked by the engine. Its liability to obstruction, and the fact that it operates only while the engine is in motion, constitute the chief objections to it. Many boats employ subsidiary pumping engines which supply water during the stoppage of the main engine.

"The self-acting pumping apparatus of Mr. Barnum is brought into action by a float, the fall of which below the due water line opens a valve which supplies steam to a subsidiary pumping engine. A deficiency of water sets the pump in action, without the agency of the engineer, and a full supply stops it. An ingenious double valve has been applied to it which prevents the pressure of the steam from counteracting the weight of the float, thus rendering it applicable to high as well as low pressure boilers. The trials made by the board of examiners with this apparatus were in general highly satisfactory.

(To be continued.)

DIMENSIONS AND DETAILS OF NEW STEAMERS.

THE IRON STEAMERS "DUMBARTON CASTLE" AND "MAID OF LORN."

Builder's Measurement.	Dumbarton Castle. Ft. Ins.	Maid of Lorn. Ft. Ins.
Length aloft	115 8	83 0
Keel and fore-rake	115 8	81 6
Engine-space	35 0	29 8
Breadth of beam	17 2	14 3
Depth of hold	8 4	9 0
Tonnage.	Tons.	Tons.
Hull	$165\frac{67}{94}$	$79\frac{49}{94}$
Engine-space	$54\frac{84}{94}$	$48\frac{17}{94}$
Register	$110\frac{77}{94}$	$31\frac{32}{94}$
New Measurement.	Ft.	Ft.
Length on deck	114.7	82.5
Breadth on do., amidships ...	16.7	13.6
Depth of hold, do.	8.2	8.9
Length of engine space ...	35.0	29.7
Length of break deck ...	...	23.3
Breadth of do.	...	19.7
Depth of do.	...	2.8
Tonnage	Tons.	Tons.
Hull	$134\frac{41}{100}$	$96\frac{18}{94}$
Break deck	...	$13\frac{20}{94}$
		$110\frac{14}{94}$
Engine room	$51\frac{87}{100}$	$38\frac{87}{100}$
Register	$82\frac{54}{100}$	$71\frac{21}{100}$

One steeple engine in each of 59 horse nominal power.

	Ft. Ins.	Ft. Ins.
Dia. cylinder	43	43
Length of stroke	3 6	3 6
Paddle wheels, dia. extreme ...	15 2	15 0
Do. effective	14 8	14 6
Length of floats	6 8½	3 3
Breadth of do.	1 3	1 6
No. of do.	14 0	12 0

The *Dumbarton Castle* has been fitted this year with a new tubular boiler, on Mr. David Napier's patent principle, with 333 tubes, 2¼ inches internal dia., and two furnaces. Steam pressure, 10 lbs.; 31½ revolutions per minute; consumption of fuel, 5 tons 8 cwt. per day of 10 hours. Frames, $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ inch and 4 feet apart.

This vessel was built by Mr. George Mills, at Little-Mill, county of Dumbarton, in 1840. The engine and boiler by Messrs. T. Wingate and Co., Springfield, Glasgow. She is the first iron vessel built at Little-Mill, and was designed by the builder. There is a great rise in the shear forward, not usual in other steamers. She has one deck; no galleries; one mast, sloop rigged; standing boltsprit; scroll figure head; clipper bow; and is a square-sterned and clinker-built vessel. Port—Glasgow.

The *Maid of Lorn* runs from Glasgow to Inverness, and was built to compete with the steamers of the other company, viz., the *Cygnet* and *Lapwing*. She makes the passage between Greenock and Ardrishaig, at the entrance of the Crinan Canal, 69 miles, in 4½ to 5 hours. Consumption of fuel in a return passage, 16 tons 16 cwt.; contents of bunkers, 19 tons; draught, 7 feet 6 inches fore and aft, with three floats in the water. No. of revolutions, 30.

Seven strakes of plates from keel to gunwale. Frames, $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$ inch, and 1 foot 8 inches apart.

Launched 1st August, and commenced running on 20th August 1849. Crew, 12 in number, viz., 5 in captain's department, 3 in the steward's, and 4 in the engine-room.

The *Maid of Lorn* has a bust female figure-head; no galleries, two masts, schooner-rigged, topping-up boltsprit, and is a round-sterned, and clinker-built vessel, with forecastle, and main, and break-decks. Commander, Mr. John Colquhoun, late of the *Maid of Marven*.

THE CORK STEAM SHIP COMPANY'S VESSEL, "OCEAN."

Built by Messrs. W. and T. Wilson, of Liverpool. Engines by Messrs. Scott, Sinclair, and Co., Greenock.

Builder's Measurement.	Ft. In.
Length aloft	159 7
Keel and forerake	159 7
Breadth of beam	25 1
Do. over paddle-boxes	42 10
Depth of hold	15 8
Length of engine space	55 2

Tonnage.	Tons.
Hull	$509\frac{73}{94}$
Engine space	$207\frac{76}{94}$
Register	$301\frac{91}{94}$
New Measurement.	Feet.
Length on deck	154·7
Breadth on do. amidships	22.6
Depth of hold do.	15·4
Length of Engine space	55·2
Tonnage.	Tons.
Hull	$507\frac{40}{100}$
Engine space	207
Register	$300\frac{40}{100}$

Two side lever engines of 234 horse nominal power. Cylinders, 56 in. dia. × 5 ft. 6 in. stroke; paddle-wheels, dia., extreme, 23 ft. 6 in., do. effective, 23 ft.; floats 7 ft. × 1 ft. 11 in.; three sets of 24 arms and floats; the original paddle-wheels were 20 ft. dia., and the floats 10 ft. wide; speed 10 knots, making 21 revolutions, with 7 floats in the water, at an average draught of 12 ft. forward, and 13 ft. aft.; steam pressure 8lbs; consumption of fuel, 15 cwt. per hour; the original flue boilers have been replaced by three tubular boilers, 13 ft. long and 10 ft. high; midship boiler, 8 ft. 4 in.; wing-boiler, 5 ft. 6 in. wide; seven furnaces, 7 ft. long, × 2 feet broad × 4 ft. 7 deep; 365 tubes, $2\frac{3}{4}$ in. dia., and 10 ft. long; made by Horton and Co., of Liverpool.

This vessel was built in 1836 for the late St. George's Steam Navigation Company, and ran between Liverpool and Cork. She runs at present between Glasgow, Dublin and Cork.

From Glasgow to Dublin	224 miles.
From Dublin to Cork	210 miles.

The *Ocean* has a full male figure-head *(Neptune)*, false galleries, two masts, schooner-rigged; standing-boltsprit; and is a square-sterned, and carvil-built vessel of timber, with main and break-deck. Port of Cork. Commander, Mr. Robert Stavely.

THE CASTLE ROYAL MAIL STEAM NAVIGATION COMPANY'S IRON VESSELS "CARDIFF CASTLE" AND "CRAIGNISH CASTLE."

Built and fitted with engines by Messrs. Caird and Co., Greenock.

Builder's Measurement.	Ft.	In.
Length aloft	172	7
Keel and forerake	171	6
Breadth of beam	19	3
Do. over paddle-boxes	34	9
Depth of hold	9	8
Length of engine-space	56	9
Tonnage.	Tons.	
Hull	$317\frac{42}{94}$	
Engine space	$110\frac{81}{94}$	
Register	$206\frac{55}{94}$	
New Measurement.	Ft.	
Length on deck	170·3	
Breadth on do. amidships	18·8	
Depth of hold do.	9·5	
Length of engine space	56·8	
Tonnage	Tons	
Hull	$206\frac{1262}{3500}$	
Engine space	$109\frac{2757}{3500}$	
Register	$96\frac{2005}{3500}$	

A pair of diagonal engines of 84-horse nominal power, with one vertical air-pump.

	Ft.	in.
Dia. of cylinders		34
Length of stroke	5	0
Dia. of air-pump		$28\frac{1}{2}$
Length of stroke	2	0

Paddle wheels.	Common. 1844 Ft.	in.	Feathering. 1849 Ft.	in.
Dia. extreme	18	9	19	0
Do. effective	18	$4\frac{1}{2}$	19	0
Length of floats	6	0	5	8
Breadth of do.	1	3	2	6
Sets of arms and floats	16		12	
Number in water	4		$2\frac{1}{2}$	
Draught of water	5	6	5	6

Both vessels received new tubular boilers this year.

The *Cardiff Castle*, by Messrs. Tod and M'Gregor, 1 boiler, 5 furnaces, and 212 tubes, $2\frac{3}{4}$ ins. dia. Pressure of steam, 10 lbs.; 30 revolutions per minute.

The *Craignish Castle*, by Messrs. Caird and Co., with brass tubes. Pressure, 12 lbs.; 30 to 32 revolutions per minute. Consumption of coals, 10 cwt. per hour.

Both vessels make 3 to 4 revolutions per minute more since altered, their speed is increased, and the tremulous motion of the vessel got rid of.

Eight strakes of plates from keel to gunwale. Frames, $2\frac{3}{8} \times 2\frac{3}{8} \times 3$ ins. and 2 feet 3 inches apart. Bunkers hold 19 tons of coals.

These vessels ply between Glasgow and Rothesay, 46 miles, making two trips a day, with mails and passengers.

They were designed by Alexander Denny, Esq., of Dumbarton.

Description—One flush deck—no galleries; two masts, schooner-rigged; no boltsprit; scroll figure head; square-sterned and clinker-built vessels of iron. Port of Glasgow.

Commander of *Cardiff Castle*—Mr. Dugald Weir; *Craignish Castle*—Mr. Neill M'Gill.

WEST INDIA ROYAL MAIL STEAM NAVIGATION COMPANY'S STEAM VESSEL "DEE."

Built by Messrs. John Scott and Son, Greenock. Engines by Messrs. Scott, Sinclair, and Co., Greenock.

Builder's Measurement.	Ft.	Ins.
Length aloft	215	10
Length of keel and fore-rake	215	7
Breadth of beam	35	9
Depth of hold...	30	3
Length of engine-space	76	4
Tonnage.	Tons.	
Hull	$1325\frac{64}{94}$	
Engine-space	$521\frac{33}{94}$	
Register	$804\frac{21}{94}$	
New Measurement.	Ft	
Length on deck	213.9	
Breadth on do., amidship	33.4	
Depth of hold, do.	30.0	
Length of engine-space	76.4	
Depth of do.	22.7	
Height of spar-deck	7.3	
Tonnage.	Tons	
Hull	$1847\frac{3359}{3500}$	
Engine-room	$611\frac{3071}{3500}$	
Register	$1236\frac{288}{3500}$	
	Ft.	In.
Nominal Power ... ... H. P.		434
Dia. of cylinders	0	73
Length of stroke	7	0
Dia. of air-pumps	0	$41\frac{3}{4}$
Dia. of paddle-wheels, extreme	29	8
Dia. do. (effective)	29	0
Length of floats	9	6
Breadth of ditto.	2	6

Three sets of 20 arms and floats; 8 miles per hour, at 14 revolutions; 12 miles at 19 revolutions per minute, average 16 revolutions; 2 sway beam-engines, and gothic (cast iron) framing; 3 boilers with double tier furnaces and flues.

DESCRIPTION.

Three masts, schooner-rigged, standing-boltsprit, full male figurehead, false quarter-galleries, round-sterned, and carvil-built vessel.

F. B.

ROYAL STEAM NAVY.

APPOINTMENTS, &c.

Assistant Engineers.—Ralph King, John A. Burton, William Donnison, C. R. Knight, J. H. C. Bishop, and Robert M'Ewen, to the *Cormorant*.

Alexander Brebner, to the *Dwarf*.

Trials of Steamers, &c., Woolwich.—*Vulcan*, iron screw-frigate, made 11½ knots on her trial down the river on 31st, with the tide in her favour. It is said against tide she made only 7·749 knots, which reduced the average rate to 9½ knots.

"Firebrand."—One of the men, named James Alexander, had a very narrow escape on board the *Firebrand*. While engaged in oiling the bearings, his foot slipped on the cylinder cover, and the engine, being on the Gorgon principle, he would have been crushed underneath the cross head and gear, had not the engines been providentially stopped by Mr. Maurice Johnson, the engineer of the vessel, and Mr. Newton of the factory, just in time to save him.

Irish Packet Service.—It is said to be the intention of the Admiralty (says the *Weekly Chronicle*), in the exercise of a sound discretion, to transfer the packet service between the important ports of Holyhead and Kingstown, together with the establishment at the former place, to the London, Holyhead, and Dublin Steam-packet Company, that company having expressed a desire to enter into a contract for the conveyance of the mails; and, in furtherance of that object, to purchase from the Admiralty two of their boats, the *Caradoc* and *St. Columba*. By the mode now adopted, both parties sustain severe losses. The *Banshee* and *Llewellyn*, will, it is said, be employed on the Mediterranean packet service.

STEAM NAVIGATION.

Trial of the "Manchester" and "Sheffield."—On the 6th inst., a trial of speed between the *Manchester* and *Sheffield* took place, which was so near an even race that both parties have claimed the victory. These vessels have been built to run as ferry boats between Hull and New Holland on the Humber, and are the property of the Manchester, Sheffield and Lincolnshire Railway Company.

Dimensions—*Manchester*, length of keel, 167 feet; beam, 22 feet; oscillating engines of 150 horse nominal power. Cylinders 48 inches diameter and 4 feet stroke. Built and fitted with engines by Messrs. Robinsons and Russell. Paddle wheels, 18 feet diameter; 34½ revolutions; average speed, 16½ statute miles.

Sheffield—length of keel, 150 feet; beam, 22 feet; oscillating engines of 156 horse nominal power, by Messrs. Rennie; cylinders, 48 inches diameter × feet stroke; paddle wheels, 18 feet diameter; floats, 11 feet × 18 inches; speed *nearly* 16 miles an hour.

The speeds are those stated by each of the engineers, as from the want of a proper arrangement the match could not be considered as satisfactorily decisive.

The Passenger Traffic with Ireland.—A document has been issued by the Lords of the Privy Council enforcing a new code of regulations in relation to the the carriage of passengers between Ireland and the British shores. The communication is dated from the Council Chamber, Whitehall, August 7, and contains the following clauses:—

"1. The number of deck passengers to be carried by a paddle steamer, having no cargo on deck, shall be one passenger to every ton of the builder's tonnage.

"2. The number to be carried by a paddle steamer, having cargo on deck, but none of it stowed abaft the paddle-shaft, shall be one passenger to every registered ton.

"3. The number to be carried when cargo (not live animals or poultry) is stowed abaft the paddle-shaft, shall be three passengers to every two square yards of clear space abaft the paddle-shaft.

"4. The number to be carried, when live animals or poultry are stowed abaft the paddle-shaft, shall be fixed with reference the arrangement of the vessel and cargo, so as to provide, as nearly as possible, two square yards for every three passengers, in a part of the vessel separate from the cattle and live stock.

"5. Screw steamers, in which the deck passengers are allowed to go below, and are accommodated with space on the lower deck for one half their numbers, or on that on which the bulwarks are raised, and a spar deck constructed so as to afford protection to the passengers on deck, shall be licensed to carry the same number of passengers in each case as paddle steamers.

"6. Screw steamers on which these provisions are not made, shall be licensed to carry only one passenger to every four tons of the registered tonnage.

"7. The proportion of passengers to be carried in the months of November, December, January, February, and March, shall be two-thirds the number allowed in the other months."

Captain Denham has also addressed a memorandum to the owners of steamers employed in the conveyance of passengers, recommending additional regulations, as follows:—

"Custom-house, Liverpool, August 10.

"I am commanded by the Lords of the Committee of Privy Council for Trade, to strongly impress upon the owners of steam-vessels employed in the conveyance of passengers, the propriety of making some provision for the health and cleanliness of those on board, by furnishing them with a sufficient supply of tarpauling to protect them from the weather and from the washing of the sea, and also by providing waterclosets for their use.

"Although my Lords have not thought it necessary to make these provisions compulsory, as they might do, by refusing certificates till they should be complied with, they nevertheless attach great importance to them, and will bear the subject in mind with a view to future legislation, should they find, by experience, that a necessity exists for more stringent provisions to compel the adoption of these reasonable measures.

"H. M. DENHAM,
Captain, R.N., Steam Navigation Inspector.

Experiments with Lighthouse Reflectors. — On Friday the 18th inst., three lamps were lighted at the Royal Marine Barracks, Woolwich, one a paralleloidal reflector, of the Trinity Corporation, on Captain Huddart's principle, 21½ inches diameter, 8¾ inches deep, with an argand lamp at 3½ focal distance. The second with a reflector on a plan submitted by Mr. Alexander Gordon, similar to one he had fitted for the Cape Pine Lighthouse, on the coast of Newfoundland, and the third on the same plan as the second, with the addition of a set of four annular glass reflectors. Mr. Gordon's reflector is 15½ inches diameter, 13½ inches deep, and has an argand lamp at 1½ inch focal distance. The glass annular lenses are arranged at the mouth of the third, their extreme diameter being 33½ inches. The lamps were lighted at half-past eight p.m., and the judges appointed to decide on their merits proceeded to Rainham in Essex, six miles distant, to ascertain which plan produced the best light. Mr. Gordon's plan, with the annular glass lenses, was the best when viewed full in front, and Captain Huddart's, or the kind used by the Trinity Corporation, was best when both were tried at an angle of seven degrees of divergence from the line of the observers. The Trinity Corporation light appeared the brightest as seen from various parts of Woolwich.

Holyhead Harbour and the Menai and Conway Bridges.—From the 26th report of the commissioners it appears that, on a careful examination of the Menai-bridge, the whole structure appears to be in as perfect a state as when it was first opened for the service of the public. The wrought-iron plates laid down on the wheel-tracks along the north-west carriage-way have been found to answer the purpose of saving the planking of the floor from being cut into by the wheels of carriages, and a similar protection to the floor of the south-west carriage-way is reported to be very desirable. The Conway-bridge has also been found to be in a perfect state. The number of vessels, exclusive of Queen's ships, mail packets, and pleasure yachts, which entered the Harbour of Holyhead in the year 1848, amounted to 1,445, the registered burden of which was 114,357 tons.

London, Brighton, and South Coast Railway.—This Company, it is said, have disposed of their steam-boats, which originally cost £30,000 for £15,000, to the French Government, who intend to run them between Marseilles and Geneva.

Stricter "Survey" of Passenger Ships.—A general order from the commissioners notifies to all officers of customs throughout the three kingdoms, that inasmuch as the enforcement of the Acts relating to emigrants devolves on the officers of customs, in the absence of the emigration officers, the proper officers "are to take care (in the event of no emigration agent being stationed at their port) that the course pointed out by the emigration board be duly observed." That "course" is so important to all owners of passenger ships, that we subjoin it, "*verbatim et literatim*":—"Her Majesty's Colonial Land and Emigration Commissioners having been informed that the survey required by the Passengers' Act to be held on passenger ships before clearing out has sometimes been inadequately performed, by reason of there being cargo or ballast on board at the time the survey was made, have felt it their duty to give notice that in future the survey of all ships coming within the law must be made before any cargo or ballast be shipped. Owners, charterers, and masters of vessels intending to take in cargo or ballast at one port, and to proceed to another port to take in passengers, are therefore hereby warned, that in order to avoid the trouble and expense of unloading the ship for survey at the port where the passengers are embarked, it will be indispensable that she should be surveyed at the port where she takes in her cargo of ballast, and that the master should be furnished with a certificate from the emigration officer, or, in his absence, from the officer of customs at that port, to the effect that the vessel had been duly surveyed, according to law, before the cargo or ballast was put on board, and was in all respects fit for the conveyance of passengers, such certificate to be exhibited to the emigration officer, or, in his absence, to the officer of customs at the ports where the passengers are embarked. It must, however, be distinctly understood that the possession of such certificate will not exempt the vessel from a second survey at the port where the passengers are embarked, and from the necessity of unloading for the performance of such survey, should the emigration officer at the latter port consider, from information in his possession, that such second survey is necessary.— By order of the Board, S. Walcott, Secretary.

Launch of the "Cato" and "Vernon."—The Liverpool ship-building firms, P. Cato and Co. and Vernon and Co., launched from their respective yards on Saturday, the steamers *Cato* and *Vernon*. They are intended to ply between the Liverpool and Birkenhead Ferry, and are the property of the Liverpool corporation. The *Cato* is 120 feet in length, breadth of beam 18 feet, depth 8 feet, with engines of 60 horse-power. The *Vernon* is double-bowed, with engines (both by Messrs. Fawcett and Co.) of the same horse-power as the *Cato*, and her dimensions are, length, 130 feet; breadth, 16 feet 9 in.; and depth, 7 feet 7 in.

INSTITUTION OF MECHANICAL ENGINEERS.

PROCEEDINGS.

The usual general meeting of the Members was held in the theatre of the Philosophical Institution, Cannon-street, Birmingham, on Wednesday, the 25th July, 1849; Charles Beyer, Esq., Vice-President, in the chair.

The following paper by Mr. Ramsbottom, of Manchester, was then read

On an improved Locomotive Boiler.

Without discussing the merits of the various arrangements and dispositions of the working parts of locomotive engines, the author of the present paper proposes to make a few observations respecting the most vital part of these machines, that upon which the satisfactory performance of all the details must necessarily depend, namely, the boiler.

Before proceeding to the immediate subject of this paper, it is proposed to point out one or two objections to locomotive boilers as at present constructed, which experience has brought under the author's notice; and then to describe a form of boiler which appears to him in some degree calculated to remedy the defects which will be referred to.

It is scarcely necessary to observe that the absolute power of a locomotive, or any other steam engine, is strictly proportioned to the quantity of steam which the boiler of such engine can produce in a given time; and chemists are generally agreed that the quantity of atmospheric air required (or oxygen which is the supporter of combustion), as well as the quantity of fuel, is in direct proportion to the quantity of water evaporated; or in other words, to produce more steam, it is not only necessary to supply more fuel, but also more atmospheric air in proportion to the quantity of steam produced.

It is well known that some of the locomotive engines built at the present day have from two to three times as much heating surface as those built about eight or ten years ago, and consequently, when performimg a proportionately increased amount of duty, they require from two to three times the quantity of air forcing through the fire in the same time.

The working parts of these engines have also been increased in dimensions; the cylinders from 12 inches to 15 and 16 inches diameter, the stroke from 16 inches to 20 and 24 inches, and the driving-wheels from 4 feet 6 inches to 6 feet diameter, and in many cases even more.

Notwithstanding all these enlargements and improvements, there are however two elements which have been but slightly changed; namely, *the diameter of the blast pipe*, and the diameter of the *cylindrical part of the boiler;* and as the whole of the steam (after having performed its office in the cylinders) is driven in a forcible jet up the chimney for the purpose of producing the necessary draught through the fire, and as the power required to produce this jet is so much taken from the gross power of the engine, it follows that the smaller the blast pipe is in proportion to the total heating surface of the boiler, the greater will be the resistance to the action of the piston, and the greater the loss of power on this account.

From observations made upon engines under the author's immediate superintendence, it appears that whilst the heating surface of locomotive boilers has been increased from 400 square feet (in the year 1842) to 987 square feet (in the year 1846), the blast pipe has not been in the slightest degree enlarged, but on the contrary in the latter case has been reduced in area in the proportion of $12\frac{1}{2}$ to $8\frac{1}{4}$ square inches. So that upon dividing the total heating surface or *area of production*, as it may be termed, by the size of the blast pipe, or *area of eduction* (assumed as unity), the following very instructive results are obtained:—

No. of Engine.	When built.	Area of Blast Pipe.	Heating Surface.
24	1842	1	4608
20	1842	1	5044
25	1845	1	7961
30	1846	1	12960

In the last case, then, it appears that the heating surface has been increased nearly *three-fold* in proportion to the size of the blast pipe, as compared with engine No. 24; and the reason will be obvious when it is stated that the boiler No. 30, is only of the same diameter as the first-named (No. 24), and consequently that the flue room, (which as a general rule will be as the square of the diameter of the boiler), has been slightly increased, the extra heating surface having been mainly obtained by enlarging the fire-box, by putting in a mid-feather, and by increasing the length rather than the number of tubes.

It is not necessary to enquire how far the diameter of the cylinders may affect the size of the blast pipe, nor to ascertain the amount of power which the blast pipe absorbs, though it may be stated that experience proves it to range from 10 to 20 per cent. of the gross power of the engine, according

to the number, diameter, and length of tubes, and also the speed of the engine. It may be remarked, however, that on the average a degree of exhaustion is required in the fire-box under ordinary circumstances equal to a column of water 4 inches in height, and the degree of exhaustion in the smoke-box must of course be greater than by the resistance offered by the tubes to the passage of the heated gases from the fire-box to the smoke-box.

From experiments made about $2\frac{1}{2}$ years ago upon an engine with a total heating surface of 987 feet, carrying 147 tubes of $1\frac{3}{4}$ inch external diameter and 13 feet 10 inches long, the author found that the latter force was at all velocities *three times* as great as the former; or in other words, that 66 per cent. of the total force of the blast was required to overcome the resistance offered by the tubes to the passage of the heated gases, leaving 33 per cent. only to operate upon the fuel; and it is this evil which results from the comparatively limited flue area of the boilers as at present constructed, to which attention is now more particularly called, and which it is proposed to remedy in the manner now to be explained.

From what has been said it will readily be inferred that there is some difficulty in materially increasing the power of locomotive engines, as the necessary amount of heating surface cannot be obtained without increasing the diameter or the length of the boiler, or making it oval, to all of which plans there are some objections; but by the method now proposed it will be easy to enlarge both the fire-box and tube surface from 35 to 40 per cent., without increasing either the diameter of the boiler or its length, as will be now shown.

It is proposed to construct the copper fire-box with an arched roof, the top of which shall be nearly as high as the top of the cylindrical part of the boiler. This box may of course be made any length without sensibly reducing the strength of the roof, and will require none of the stay-bars which are so essential to the security of the flat-roofed box, and which for a moderate sized engine weigh not less than 400 lbs.

With such a box the whole of the cylindrical part of the boiler can be filled with tubes, and of course the whole of the longitudinal stays be removed; and in the present instance there are 225 tubes of 2 inches external diameter, the shell of the boiler being 3 feet 8 inches diameter and 10 feet long; the total heating surface of the fire-box is 80 feet, and of the tubes 1177 feet, making a total heating surface of 1257 feet.

Such an arrangement involves the necessity of keeping the boiler full of water, and it is therefore requisite that a separate steam chamber should be provided. This, as will be perceived from the drawing, consists of a cylinder which is 13 feet long and 20 inches diameter, fixed over and parallel to the cylindrical part of the boiler, or, as it may now be termed, the generator. This tube, which has a cubic capacity of $28\frac{1}{2}$ feet, is connected at each end with the generator, as shown in the drawing at A B, fig. 2, which represents a longitudinal section of the boiler. It is proposed that the water shall occupy about one-fourth of the capacity of this tube, leaving a clear space of, say of 21 cubic feet for steam; this is rather more steam-room than most modern boilers possess, and for reasons which are afterwards mentioned, the author thinks it will be sufficient, although it may readily be increased by slightly enlarging the diameter of the steam chamber, which, as at present shown, is not so high as the ordinary steam dome by about 12 inches.

It has been proved experimentally by Mr. Robert Stephenson that the generative power of the copper fire-box is three times as great per unit of surface as that of the tubes; and independent of this authority, locomotive engineers are generally agreed that the great bulk of the steam generated in a locomotive boiler is formed upon the surface of the copper fire-box and the first 18 or 20 inches length of the tubes. As the whole of the steam has to rise through the body of the water, with which it is for the time mechanically mixed, and as the specific gravity of these mixed fluids will be much less than the comparatively *un*mixed water at the smoke-box end of the boiler, it follows that there will be a brisk circulation through the generator and steam chamber, in the direction indicated by the arrows upon the drawing. The mixed steam and water will be driven into the upper vessel, and will there be effectually separated; the former passing off to the cylinders by the longitudinal pipe C D, fig. 2, which has a number of small holes upon its upper surface, and the latter running again into the generator through the vertical connection at the front end, and thus keeping up the circulation.

That the specific gravity of the mixed steam and water at the fire-box end is often reduced to at least one-half that of water alone, is proved by the fact that the water gauge will frequently show a downward current through the glass tube, even though the circulating fluids be one half water and one half steam, showing as it does, that the column of the mixed fluids in the boiler is specifically lighter than the column in the glass gauge; and from this fact it is also evident that this great expansion is confined to the water in the vicinity of the fire-box, since, if it extended to the whole mass, the boiler would not contain the requisite quantity.

From the circumstance that no bubble of steam can rise into the steam chamber between the extremities of the generator, it is concluded that this boiler will not be so liable to prime as the common one, and therefore that the steam chamber as shown is sufficiently large. As to the water surface, which in this boiler it may be objected is smaller than in others, it is conceived that the great facilities this boiler will give to the engineer for raising steam, will leave him comparatively at liberty to put in water when and where he chooses, and consequently, that but little difficulty need be apprehended on this point. It is evident however, that the objection may be fully met by constructing the outer fire-box with a pyramidical roof in the way so common.

In conclusion, the author would express his conviction that this boiler, combining as it does a great increase of heating surface, *and corresponding increase of flue area*, with a relative diminution of bulk and weight, and great simplicity of construction, is calculated to remove some of the difficulties experienced by locomotive engineers, and to promote the best interests of the railway world in general.

The Chairman said, that in the unavoidable absence of Mr. Ramsbottom, he would observe that his object in the foregoing paper was to obtain a considerably larger area of flue-room than in the present locomotive boilers, and to make a boiler of a large heating-surface with less weight.

Mr. Slate was of opinion that for the weight the engine carried, it would have a considerably greater effective heating-surface than any previous form of boiler; but he thought the boiler would have as great a tendency to prime as any other.

Mr. Cowper was also of opinion there would be a great tendency to prime in the proposed boiler; the surface from which the steam had to rise was the entire surface of the fire-box and tubes, and all the steam had to pass through the two openings into the steam-chamber, and it appeared to him the water would be carried up there in a complete state of froth.

Mr. McConnell, while agreeing to a certain extent as to the liability of the boiler to prime, thought it might be obviated by having a more continuous communication between the generator and the steam-chamber; perhaps the steam-chamber could be fixed close upon the top of the generator, and a continuous longitudinal opening be made, communicating between them throughout their entire length. He thought the proposition of Mr. Ramsbottom was a very good one, as it was a received opinion that the proportion of the flue-room to the fire-grate surface could not be too large, supposing that full advantage was taken of the flue surface before the heated air reached the chimney. Whether long tubes or short tubes as applied to locomotives were most advantageous, was a question not yet decided; and he thought they had scarcely data enough to determine as to the advantage of long tubes on the ground of economy. It was a very important matter to determine what length of tubes was most advantageous for use in proportion to the area of the fire-grate.

Mr. C. Cowper was not aware whether there was any authority respecting the proportionate heating power of the tubes and the fire-box, besides the experiment of Mr. Stephenson, alluded to in the paper.

Mr. McConnell remarked, that it appeared from experiments made by Mr. Stephenson and Mr. Beyer, that a very considerable heat was lost in the smoke-box even at the end of the longest tubes that were used; and he thought that the air in the centre of the tubes might have a considerably higher temperature than the air at the sides of the tubes, and that much of the heat might be carried through by a stream of air like a solid bar in the centre of each tube, without ever coming in contact with the sides of the tube, and consequently without being communicated to the water of the boiler. He had been informed that it was found to be a useful practice in marine and stationary boilers, to create a disturbance in the currents of air passing through the flues, for the purpose of mixing up the particles as much as possible; and a similar advantage might probably be obtained by mixing the air in the tubes of locomotive boilers.

Mr. Gibbons said, he had observed a similar advantage from mixing the particles of air in heating the air for his blast furnaces near Dudley; the pipes through which the air was passed for the purpose of heating it were bent like a syphon, so as to cause all the particles of air to come in contact with the sides of the pipes, and the air was found to be heated much more efficiently by these bent pipes than by straight pipes.

Mr. Allen said, he had tried an engine with a ½ inch iron rod fixed in the centre of each tube; the rods were as long as the tubes and supported at intervals by shorts projecting pins to hold them in the centre of the tubes. The engine had been worked with them for some time between Birmingham and Liverpool, but no difference was found in the working and consumption of coke, as compared with the same engine doing the same work without the rods in the tubes; the result was found tobe exactly the same in both cases.

Mr. C. Cowper remarked, that the rods in the tubes would have the effect of contracting considerably the flue area, and increasing proportionately the amount of power requisite to draw the air through the tubes, and consequently the rods in the tubes would cause a loss of power to the engine from the increased resistance to the blast. He thought therefore the rods must have caused an equal amount of gain to neutralize this loss by bringing the air into more effective contact with the sides of the tubes, as the result showed no loss on the whole..

Mr. McConnell thought it was certain at least that the use of the rods did no harm; and it must either be considered that there was no advantage in a large flue area, or that there was considerable advantage in mixing the air in passing through the tubes.

Mr. Slate was of opinion, that even on the ground of economy a large number of tubes was advisable, because with the violent and frequent action of the pieces of coke the tubes were soon worn out; whereas by increasing the number of tubes the velocity of the draught would be diminished, and the tubes would be less worn and would last longer.

The Chairman remarked, that the larger the area of the flue, the better it was for the engine, as it must offer less resistance to the blast-pipe; but he was not certain what this resistance actually amounted to.

Mr. Cowper said, that Mr. Daniel Gooch had found from his indicator card, that the resistance of the blast-pipe amounted to 11 or 12 lbs. per square inch, at a moderate velocity of about 30 miles an hour.

Mr. McConnell observed, that as a certain quantity of heated air had to be conveyed from the fire-box to the chimney, and a certain area of heating surface was also required, there would be an important reduction effected in the resistance of the blast-pipe by increasing the number of tubes, so as to increase the area of passage and reduce the length of the tubes, diminishing proportionately the resistance of the air passing through the tubes.

The Chairman said, he was present when the experiments were tried that were mentioned by Mr. Ramsbottem, to ascertain the difference between the degree of exhaustion in the smoke-box and in the fire-box; the experiments were tried with a long boiler engine, and a glass water guage was fitted into the smoke-box and another into the fire-box. The degree of exhaustion in the smoke-box averaged three times as great as that in the fire-box, and this proportion was found to be nearly the same at all velocities; the greatest amount of exhaustion observed in the smoke-box supported a column of water 13 inches high. He thought that the whole resistance of the blast-pipe and the back pressure in the cylinder, did not amount to more than 15 per cent. of the power of the engine.

Mr. Slate remarked, that assuming it to be 15 per cent. it followed that 10 per cent. of the whole power of the engine was absorbed by the friction of the air in passing through the tubes, as the exhaustion in the smoke-box was three times as great as in the fire-box; or one-third only of the pressure of the blast was effectively acting in the fire-box.

Mr. McConnell thought it was an important subject for investigation, to ascertain the actual power lost by the resistance of blast-pipes of different sizes, and under the different circumstances of size and number of tubes. In his own practice he had found that small tubes and many of them produced the best effect; the limit in reducing the size of the tubes was their stopping up with pieces of coke whilst working.

The Chairman said, he thought there was some advantage in the form of boiler proposed by Mr. Ramsbottom, and that amongst the various modifications that had been proposed of the locomotive boiler, there was not one that was so likely to be useful.

A vote of thanks was passed to Mr. Ramsbottom for his paper.

PARIS ACADEMY OF SCIENCES.

M. Regnault presented on behalf of M. Blanquart Evrard, of Lille, several specimens of photography on paper, obtained by means of a matrix on albumen, rendered sensible to the action of light, by its admixture with the aceto-nitrate of silver, and spread in a thin layer on a plate of glass. The new matrices obtained by means of the preparations which M. Blanquart Evrard describes in his communication, are unalterable to the light; lose none of their qualities however long the time they may be used; are capable of being renewed if by accident they should be lost, provided that one proof of the lost matrix remains; and lastly, can at all times, and under all temperatures and variations of light, furnish satisfactory results. The following is the mode of preparation indicated by M. Blanquart Evrard:—

Collect in a deep vessel a certain number of whites of eggs—remove the whole of the solid or non-transparent part, and take care to protect it from dust, add 15 drops of a saturated solution of iodide of potassium; beat the eggs into a froth, and allow it to settle until the froth returns to the liquid state. Clean the glass which is to be employed with spirit of wine, place it on a support, beyond which the edges of the glass may project, and pour over it a sufficient quantity of albumen; spread this albumen over the whole surface of the glass, employing a piece of glass for this purpose, the edge of which comes in contact with the surface of the glass: this operation must be repeated several times; its object being to cover the surface of the glass with a perfect coating of albumen, so that it may remain well covered when hung up by one of its corners to drain off the excess of albumen.

After this last operation, the glass is placed quite flat and allowed to dry. The albumen having been well dried, the glass is submitted either to a very high temperature, or, to what amounts to the same thing, to a very low temperature, until the layer of albumen presents an uniform croched surface. Care however must be taken that this part of the process is not carried too far, lest the albumen should peel off. The glass having undergone this preparation, must next be submitted to the action of a solution of aceto-nitrate of silver (of the strength indicated in the communication of the 20th of January, 1847): care must be taken that the contact of the aceto-nitrate with the albumen shall be effected at one operation, for if the glass were several times immersed in the solution, different layers would be formed, arising from the contraction which the albumen undergoes on its combination with the aceto-nitrate. This part of the process may be accomplished most readily by proceeding as follows:—In a basin, a size larger than the albumenized glass, is put a solution of aceto-nitrate of silver, to the depth of a quarter of an inch; an inclination of 45 degrees being then given to the basin, the edge of the glass is placed in the solution, the albumenized side towards the bottom of the basin; then by a simultaneous movement, the glass is allowed to fall in the basin and the basin to regain its horizontal position on the table. This done, the glass is immediately removed from the basin, immersed in a basin of water, and briskly stirred for several seconds, and lastly drained by holding it by one of its corners and striking the opposite one briskly on the table. Glass thus prepared, becomes completely photogenic. It may be employed indifferently either in a moist or a dry state, if it be required for use at a distance or on a journey. The impression may even be made to appear after exposure to the camera obscura, either immediately or after a return from a journey. This operation is performed (as M. Blanquart Evrard has already indicated for paper in his communication to the academy in November, 1847), in a bath of a saturated solution of gallic acid; it will, however, be useful in order to give the impression a full effect, to add a little aceto-nitrate of silver to the solution of gallic acid. It will be prudent to withdraw the impression from its immersion in the gallic acid before its different parts acquire the tone desired, for if the action be pushed too far, the deep tones it then presents cannot be afterwards diminished, whereas on the other hand, if the shades are too faint, the impression may, without danger, be again subjected to the action

of the gallic acid, notwithstanding the matrix had already been served to produce a great number of impressions. After this operation, the glass should be washed in a large quantity of water, then dipped into a solution of bromide of potassium (20 parts to 100 of water, and lastly again washed in a large quantity of water, and dried in a darkened room in an horizontal position. Treated in this way, the albumen on the glass acquires such a degree of hardness and solidity, that when it is required to destroy an incomplete impression, in order to use the glass again, it is necessary to have recourse to a very powerful chemical agent, such, for instance, as the cyanide of potassium, to remove the coating of albumen.

PATENT LAW REFORM.

(Continued from p. 211).

SELECTIONS FROM EVIDENCE.

Mr. Frederick William Campin, examined.

364. Are you acquainted with the business of obtaining patents for new inventions?—Yes; perfectly well. I have been in the practice of passing patents for about 10 years.

371. Will you be good enough to explain the process by which a patent is obtained?—In order to obtain a patent, we have first of all to present a petition to the Queen, asking for the grant of a patent for either England, Scotland, or Ireland, as the case may be. Accompanying that petition is a declaration made before a Master in Chancery, verifying the truth of the statement therein, that the patentee believes that he is the first and true inventor of certain improvements, whatever they may be—for instance, in steam-engines. That has to be taken to the office of the Secretary of State for the Home Department, and left for his reference to the Attorney or Solicitor General, to make a report to the Queen in favour of granting the patent. That report is obtained from the Attorney or Solicitor General's chambers, and has to be carried back to the office of the Secretary of State, where a warrant, signed by the Queen and countersigned by the Secretary of State, is made out. That warrant is then taken to an office called the "Patent Bill Office," for the Attorney or Solicitor General to prepare a bill, which is a sort of draft of letters patent on parchment. This bill has then to be taken to the Home Office again for the Queen's signature, and then it is passed into the Signet Office, where the Signet Bill is made out; then I believe it is passed on to the Privy Seal (we never get the Signet Bill at all), where the Privy Seal is given to it, and it is then taken to the Lord Chancellor's principal Secretary's office in order that the patent may be made out and sealed with the Great Seal: it is then made out; the grant is complete and handed over to us—the patent is all complete now.

372. In case a general caveat has been lodged with the Attorney General, whose duty is it to give notice?—It is the duty of the Attorney or Solicitor General's clerk.

373. Does the patent agent attend to the sending out of notices?—Caveats are usually entered in the names of the patent agents, and not in the names of their clients, and for this reason principally, that it is advisable, until a person has secured himself by obtaining a patent, that he should not be known as having any invention in progress; therefore, the patent agent's name is used, and the notices come to him, and it is his duty to give notice to his clients.

380. What is the meaning of the general caveat deposited with the Attorney General; is not that a notice that no person is to take out a patent which is similar to the invention which the person entering the caveat has introduced?—In giving in a caveat, we give nothing more than is given at starting with a patent—namely, a title. For instance: we enter a caveat against any improvements in steam-engines, and we then receive a bare notice that Mr. So-and-So has applied for a patent for an improvement in steam-engines; but we are quite in the dark as to what may be the nature of the petitioner's invention till we come before the Attorney or Solicitor General to have it decided.

381. What is the nature of the question which the Attorney General would have to decide upon the policy of granting a patent for an improvement in the steam-engine?—He would merely have to decide whether the petitioner's particular improvement in the steam-engine was the same as that of the opponent's.

406. The Queen's prerogative of granting monopolies for new inventions extends not only to the United Kingdom, but to all the plantations abroad?—Yes, to all the colonies and plantations abroad.

407. Is there any difference in the fees paid in those different cases?—Yes; the fees on a patent, including the colonies, are these:—They begin at the Home Office with the warrant, and it makes about £8 difference, in round numbers?

421. In case of opposition being made at the Great Seal, will you describe the proceedings that take place?—We have to enter a special caveat, just the same as the one entered at the Patent Bill Office, describing the name of the party that we wish to oppose, and his title. Then it is referred to the Lord Chancellor, and he appoints a day of hearing; and there are other proceedings. The opposition at the Great Seal is a matter in the Court of Chancery.

425. Having traced the patent through its successive stages, will you state whether you think the present mode of granting patents is a convenient one?—My opinion is, that it is not so convenient as it might be made, undoubtedly; but I think it is a matter of perfect indifference to patentees and inventors: what they look at is the expense: it matters very little to them what arrangements the Government choose to make in public offices, *so that they get their rights insured to them in a perfect manner, and at a small cost.*

426. Would it be possible to obtain less delay?—There is only one way to do it, and that is by *dating the patent from the day that a person applies for it.*

448. Supposing the proceeding for obtaining a patent was of this nature—that an application was made, in the first instance, by petition to the Crown to grant a patent; that it should be sent to the Home Office; that the Home Secretary should refer the matter, as at present, to the Attorney or Solicitor General; that the Attorney or Solicitor General should, after notice given to all parties interested, and after advertisement, if necessary, report his opinion to the Home Secretary; that the Home Secretary should then cause an instrument to be prepared, which should be transmitted direct to the Great Seal, giving an opportunity to the parties, if necessary, to make opposition before the Lord Chancellor—do you think that any effectual security would be omitted in such a process as that?—I should rather retain the Privy Seal, and allow the opposition there, and have two stages of opposition before the Attorney General; because the opposition at the Great Seal is a most serious matter. It is a matter in the Court of Chancery which, first and last, costs £500 or £600.

449. Is opposition, in fact, ever made before the Privy Seal?—Never at the present moment.

450. Why, then, do you wish to retain the Privy Seal?—Because I should wish to retain the power of making the second opposition before the Attorney or Solicitor General.

451. Why do you wish to retain the power of making a second opposition?—For this reason; if I have a client who lives in France, it is almost impossible, supposing it is a remote part, such as Marseilles, to send the seven days' notice to him. He gets that notice, but it is almost impossible for him to think upon the subject and send me back definite instructions in time to enter an opposition, and come before the Attorney General in the first instance; and it may be of sufficient importance to him to wish to stop the party from getting that patent; it may be of the utmost importance to him; it may be a person who has got his invention from him in France, and who has come here to England with it, and he could oppose on the bill under the present system.

452. Would not that object be gained by requiring longer notice?—But then there are always contingencies, that give a notice as long as you please, you cannot meet at a definite moment.

453. Why does the power of making opposition at the Patent Bill office prove effectual if it is not by lengthening the period of notice?—But then, that might be inconvenient to some parties—to a great number of persons, that such a lengthened notice should be given of the hearing, whilst, at the same time, it is also convenient that some future opportunity for opposition should be afforded.

454. Does not the present system render it necessary that the notice

should be long, by requiring two stages before the Attorney General, instead of one; and does not that apply to all parties?—No. If you oppose on the report you get a hearing in eight days, and the matter is done with.

455. But still opposition in that case might be made at the Patent Bill office?—You would scarcely ever think of opposing a second time, if you have had the decision of the Attorney General once on the question. I cannot see the good of going before the same officer again.

456. Do you suppose the case of a person who is not in time at the report, and who comes in at the Patent Bill office?—Yes.

457. In such a case at present, there might be opposition from one party at the report, and from another party at the Patent Bill office?—Just so.

458. Would not that create an equal delay with the course you appear to condemn?—No, it would not; because we are not to suppose that a contingency would always happen, and a person opposed at one stage and then at another; you see, if you give a lengthened notice they must be stopped, in all cases, that time.

459. Does it ever happen, where an opposition has been made by one party, that the knowledge of that opposition has led to opposition from any other parties?—Not that I am aware of.

460. You stated with regard to a person abroad, it would as well to have time to communicate with him, in order that he should be able to oppose at the special hearing; but at present, if he opposes at the special hearing, he is obliged, as you stated in a former part of your evidence, to lodge £30; and in the event of his succeeding in overthrowing a patent, he pays the whole amount of the previous costs, and thereby he would suffer a greater injury under the present practice than if greater time were given, and only one hearing allowed?—Perhaps he might. But then, if you give long notice—if you oblige the Attorney General to give a long notice, in the first instance, of any opposition that there might be, of course there would be no person able to get a patent, except after the expiration of that long notice. Now, it is merely the contingency, or chance of that, that such person is subject to.

461. If you made the notice, required on the part of the Attorney General now, as long as elapses between the first and the second hearing, there would be the same protection to the public, and there would be the same acceleration of the business to the person taking out a patent?—I cannot see that. It is not every person who is opposed at both stages, therefore as regards those persons whose patents are not opposed at both stages (and they are the majority,) they would, under the present system, get their patents after a delay of eight days, whereas, you would make it perhaps a delay of 21 days. Now they are only liable to the contingency of a second opposition.

469. Is the applicant for a patent ever damnified by the interval which elapses between the first application and the sealing of the patent?—Yes, he is, sometimes, and the more so by the present system at the Designs Office. A person sometimes registers a design—it is a short process—and this operates in this case precisely similar to a person taking out a patent.

470. Will you describe in what manner an applicant for a patent receives injury from the delay that occurs according to the present system?—By some one getting a knowledge of his invention, and not thinking it worth while to take out a patent, and bringing it out and exhibiting it in his shop to the notice of the public before the date of the seal, or by registering under the Designs' Act between the interval which elapses.

471. What is the usual interval between the application for a patent and the sealing of it?—About a month.

472. Does it often happen that the exclusive right to a patent is anticipated, as you have described?—Not very often, I should say.

473. But such cases occasionally occur?—Yes.

474. What is the usual expense of obtaining a patent?—The usual expense is about £110 without the colonies, and with the colonies about £115, that is including the agent's fees.

475. That is for the United Kingdom?—No, that is for England.

476. For the United Kingdom what is the expense of a patent?—The expense for Scotland is £75, for Ireland £135; that will make it about £300. There is the expense of the specification afterwards.

481. Supposing all fees upon patents were abolished, and a simple stamp duty upon a patent were substituted, what ought to be the amount of that stamp duty?—I beg to say that I am in favour of the same policy as that pursued in France, of taking the duties by annual instalments of a moderate amount. The greater part of inventors are in reality men in very humble circumstances.

482. You think there ought to be an annual tax upon a patent?—Yes; and my object is this, that you shall not give a patent for trifling things, so as to induce people to take out patents for worthless things, but at the same time to afford to a poor man facility for getting his invention protected, that he may not lose it by the circumstances of his position.

483. Supposing a patent were granted for seven years, how much would you make the duty payable each year for the whole three kingdoms?—About £10 a-year.

497. Is there any other suggestion you would wish to make?—Yes, that every party should deposit at the time of the application an outline description of his invention, which should be binding as to the principles of the invention, so that he shall not merely make a bare statement of certain improvements in so-and-so, and then go about and collect from everybody—perhaps persons having patents already—their ideas, which he places in his specification afterwards.

498. Would it be possible to embody the specification in the original grant?—Not the specification itself, because you are bound to give in a specification of the exact and correct details of the invention, and there is no one who can give these until he has ascertained them from experiment and research, and after building models of engines and so forth.

505. You would suggest that an index should be kept at some office to which the public could have access?—Yes; the Commissioner of Patents in the United States publishes every year a report of that kind of all patents that have been granted arranged in that way.

506. At which office do you think it would be desirable that this register should be kept?—At the Great Seal Office—the Lord Chancellor's office.

507. In case of an application for the prolongation of a patent, is not that a proceeding before the Privy Council?—It is.

508. Where a patent is to be renewed, no part of the process you have been describing applies?—Yes, it does. The Order in Council is, that an extension of the patent shall be made; then it passes through precisely the same forms, from the warrant upwards, as if it were a new patent.

(To be continued).

LIST OF ENGLISH PATENTS

From August 30th, 1849, to September 6th, 1849, inclusive.

Thomas Symes Prideaux, of Southampton, gentleman, for improvements in puddling and other furnaces; and in steam boilers. Patent dated August 30; six months.

James Robinson, of Huddersfield, in the county of York, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. Patent dated August 30; six months.

Charles Morey, of Manchester, gentleman, for certain improvements in machinery or apparatus for sewing, embroidering, and uniting or ornamenting by stitches, various descriptions of textile fabrics. Patent dated August 30; six months.

George Baxter, of No. 11, Northampton-square, Clerkenwell, late of Charterhouse-square, in the county of Middlesex, engraver and printer, for his invention of improvements in producing coloured steel-plate, copperplate, and other impressions. Patent dated August 30; six months.—(Being an extension of his former patent for the term of five years.)

Isidore Bertrand, of France, engineer, for improvements in protecting persons and property from accident in carriages. Patent dated August 30; six months.

Onesiphore Pecqueur, of Paris, civil engineer, for certain improvements in the manufacture of fishing and other nets. Patent dated August 30; six months.

Malcolm Macfarlane, of Thistle-street, Glasgow, North Britain, coppersmith, for certain improvements in machinery or apparatus for the drying and finishing of woven fabrics. Patent dated August 30; six months.

Charles Cowper, of Southampton-buildings, in the county of Middlesex, for improvements in machinery for raising and lowering weights and persons in mines; and in the arrangement and construction of steam engines employed to put in motion such machinery, part of which improvements are applicable to steam engines generally. Patent dated August 23; six months.—(Communication.)

Frederick Chamier, of Warwick-street, in the county of Middlesex, commander in the Royal Navy, for improvements in the manufacture of ships' blocks. Patent dated August 23; six months.—(Communication.)

William Edward Newton, of London, civil engineer, for certain improvements in steam boilers. Patent dated August 23; six months.—(Communication.)

Alfred Vincent Newton, of London, mechanical draughtsman, for improvements in manufacturing and refining sugar. Patent dated August 23; six months.—(Communication.)

Alexander Haig, of Smith-street, Stepney, engineer, for an improved apparatus for exhausting and driving atmospheric air and other gases; and for giving motion to other machinery. Patent dated September 6; six months.

Alexander Robert Terry, of Manchester-street, Manchester-square, engineer, for improvements in the manufacture or preparation of firewood. Patent dated September 6; six months.

Josiah Marshal Heath, of Hanwell, in the county of Middlesex, gentleman, for improvements in the manufacture of steel. Patent dated September 6; six months.

Sir John MacNeill, knight, of Dublin, and Thomas Barry of Lyons, near Dublin, mechanic, for improvements in locomotive engines; and in the construction of railways. Patent dated September 6; six months.

John Hosking, of Newcastle-upon-Tyne, engineer, for an improved pavement. Patent dated September 6; six months.

LIST OF PATENTS

THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND, FROM THE 21ST DAY OF JULY, TO THE 22ND DAY OF AUGUST, 1849, INCLUSIVE.

James White, of Lambeth, in the county of Surrey, civil engineer, for improvements in machinery or apparatus for sowing seed. Sealed July 25; six months.

James Green Gibson, of Ardwick, near Manchester, in the county of Lancaster, machinist, for certain improvements in machines used for preparing to be spun or spinning cotton and other fibrous substances, and for preparing to be woven and weaving such substances when spun. Sealed July 30; four months.

Andrew Peddie How, of the United States, but now residing at Basinghall-street, in the city of London, engineer in the United States navy, for an instrument or instruments for ascertaining the saltness of water in boilers. Sealed August 1; six months.—(Communication.)

Hugh Lee Pattinson, of Washington House, Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound or compounds of lead, and the application of a certain compound or certain compounds of lead to various useful purposes. Sealed August 6; six months.

Amadée Francois Remond, of Birmingham, for improvements in machinery for folding envelopes, and in the manufacture of envelopes. Sealed August 6; six months.

Richard Kemsley Day, of Stratford, in the county of Essex, hydrofuse manufacturer, for improvements in the manufacture of emery paper, emery cloth, and other scouring fabrics. Sealed August 7; six months.

John Thom, of Ardwick, near Manchester, calico printer, for improvements in cleansing, scouring, or bleaching silk, woollen, cotton, and other woven fabrics and yarns when printed. Sealed August 7; four months.

Joseph Findlay, of New Sneddon-street, Paisley, in the county of Renfrew, North Britain, manufacturer, and Andrew Wilkie, of the same place, turner, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing, wood or other substances. Sealed August 10; six months.

James Thomson Wilson, of Middlesex, chemist, for improvements in the manufacture of sulphuric acid and alum. Sealed August 15; six months.

Edward Lord, of Todmorden, in the county of Lancaster, machinist, for certain improvements in machinery or apparatus applicable to the preparation of cotton and other fibrous substances. Sealed August 15; four months.

Pierre Armand le Comte de Fontainemoreau, of South-street, Finsbury, for certain improvements in weaving. Sealed August 22; four months.—(Communication.)

LIST OF PATENTS

THAT HAVE PASSED THE GREAT SEAL OF IRELAND, FROM THE 21ST DAY OF JULY, TO THE 21ST DAY OF AUGUST, 1849, INCLUSIVE.

Thomas Robinson, of Leeds, in the county of York, flax dresser, for improvements in machinery for breaking, scutching, cutting, hackling, dressing, combing, carding, drawing, roving, spinning, and doubling flax, hemp, tow, wool, silk, and other fibrous substances, and in uniting fibrous substances. Sealed August 7; six months.

John Edward Hawkins Payne, of Great Queen-street, in the county of Middlesex, coach-lace manufacturer, and Henry William Currie, engineer, in the employ of the said John Edward Hawkins Payne, for improvements in the manufacture of coach-lace, and in other similar looped or cut-pile fabrics. Sealed August 7; six months.

ANALYSIS OF PATENTS.

Joseph Sharp Bailey, of Bradford, in the county of York, spinner, *for certain improvements in preparing, combing and drawing wool, alpaca, mohair, and other fibrous materials.* Patent dated October 5, 1848.

THE patentee claims: first—The arrangement and construction of apparatus and machinery for preparing wool, alpaca, mohair, and other fibrous material for the process of combing, having rollers revolving at different velocities, which are provided with projecting teeth or points, and with bristles or brushes, the points of which are longest, and of a coarser thickness and pitch upon the roller nearest to the feeding rollers, and decreasing in length, pitch, and thickness, as they are more distant from them; the brushes of which are longest upon the brush roller nearest to the feeding rollers, and shorter as they are more distant from them; also, the mode of charging such prepared fibrous materials upon combs, by means of a revolving frame, carrying such combs in manner as hereinbefore described.

Secondly—The general arrangement and construction of machinery and apparatus hereinbefore described, for combing wool, alpaca, mohair, and other fibrous materials; and severally, the combing of such fibrous materials by the employment of combs attached to revolving frames or arms, moving or revolving in opposite directions, at different velocities, by which the combs are caused to approach each other in manner hereinbefore described.

Thirdly—The arrangement and construction of machinery for drawing wool alpaca, mohair, and other fibrous materials from combs into slivers, wherein such combs are, during the process of drawing caused to approach towards the drawing rollers, in a direction at or near a right angle to the faces of the combs; also the application of a clearing comb, placed between the holding comb and the drawing rollers, the direction of the teeth of which is parallel to those of the holding comb; also, the mode of obtaining a variable movement by means of the adjusting traversing lever hereinbefore described, whether applied to any present improvements, or to any other machinery, or apparatus for preparing, combing, or drawing, fibrous materials; also the employment of an endless apron passing between the drawing rollers, formed of vulcanized india-rubber, or of other materials (as leather) coated or covered with vulcanized india-rubber; and also the application of drawing rollers having finer or auxiliary grooves upon the surfaces of the ordinary or larger grooves.

Fourthly—The heating of combs employed in the combing of wool, alpaca, mohair, and other fibrous materials, by means of steam or heated air applied, as hereinbefore described.

Charles De Bergue, of Arthur Street, West, London, Engineer, *for improvements in bridges, girders and beams.* Patent dated October 12, 1848.

THIS invention consists of a bow-string girder, the upper part of which, subject to compression, is composed of cast-iron piping, bolted together, and the lower part or tension-rods, of steel or bar-iron, rivetted together. Over the flanges of the pipes are clips of bar-iron, which form the suspension-bars, and they are braced by diagonal stays, as is usual in such structures. Timber may also be used for the upper part. The patentee claims the general arrangement, and the application of tension bars of steel, or iron and steel rivetted together.

Arthur Dunn, of Dalston, chemist, *for improvements in ascertaining and indicating the temperature and pressure of fluids.* Patent dated Octber 12, 1848.

THIS invention consists in arranging a mercurial pressure guage in such a way that when the mercury is raised to a determinate pressure it comes into contact with a platina point, connected by wires to an ordinary telegraphic bell-ringing apparatus, worked, as usual, by a small battery.

Daniel Watney, of Wandsworth, Surrey, distiller, and James John Wentworth, of the same place, *for improvements in machinery for drilling metals and other substances.* Patent dated October 12, 1848.

This invention may be described as a swivelling frame for supporting a drill-brace. A rectangular frame of suitable height has a foot on which it swivels, and a set screw at top, by means of which it can be fixed, between two parallel surfaces. On the sides of the frames, slides a block, which can be tightened and fixed at any height, and this block carries a boss swivelling vertically, provided with the ordinary set screw for the end of the drill-brace. By this means the drill-brace can be set at any height and at any angle with its work.

Elias Robinson Handcock, of 16, Regent Street, London, and Rath Moyle House, Queen's County, Ireland, Esq., *for certain improvements in mechanism applicable to impelling and facilitating the propulsion of vessels in the water; which improvements are applicable to locomotive engines for railways, and other similar purposes.* Patent dated October 12, 1843.

This invention relates to rotary engines, and consists of a wheel having a ring turned out of each side near the periphery. These rings are closed by annular cylinder covers supported by a framing on each side of the wheel. These covers are packed, very ingeniously of course, to allow the wheel to revolve on a central shaft without any leakage past the stationary covers. A plate of metal slides transversely through each cylinder cover to act as a fulcrum, and a block of metal is fixed in each ring to act as a piston. The fulcrum is withdrawn at the proper instant to allow the piston to pass.

Peter Fairbairn, of Leeds, Yorkshire, machine maker, *for improvements in machinery for hackling, carding, drawing, roving, and spinning flax, hemp, tow, silk, and other fibrous substances.* Patent dated October 26, 1848.

The patentee claims, first, the application of a circular or rotary gill to a machine for drawing wool, flax, and other fibrous materials, so that the sliver shall pass between the teeth of the gills in a tangential direction to the rotary motion of the gill, and for the purpose of opening only the fibres of the sliver in the immediate vicinity of the sliver, without the same being held back, or allowing it to lap around the gill.

Secondly, the connecting together pairs of holding rollers and pairs of drawing rollers, whatever may be the construction of the gill or the machinery employed, so that they may revolve with the same surface velocity, and thereby cause the sliver to advance uniformly.

Thirdly, the adaptation and application of gill drawing machinery, of whatever construction, to machines employed for carding tow, short-fibred flax, or other similar material.

Fourthly, the peculiar construction of the case or shell for the covering the wheels of revolving rubbers or cleaners, such cases or shells being also made to carry the shafts or axles of the cleaners.

Fifthly, the construction of the paul ratchet-wheel holder, for keeping the drawing rollers of drawing machinery in contact with each other.

Sixthly, the adaptation and application to machinery, employed in manufacturing flax and tow, of moveable and adjustable radial arms, for carrying intermediate wheels, several distinct wheels being mounted and actuated thereon, whether fixed on shafts, or mounted upon studs.

Seventhly, the arrangement and adaptation, likewise, to roving machinery employed in manufacturing flax and tow, of wheels mounted upon a jointed arm, as described.

William Church, civil engineer, and Thomas Lewes, woollen draper, both of Birmingham, *for a certain improvement or certain improvements in machinery to be employed in making playing and other cards; and also other articles made wholly or in part of paper or pasteboard, part or parts of which said machinery may be applied to other purposes where pressure is required.* Patent dated October 26, 1848.

This invention consists, first, of a machine for cutting to size, and punching, cards. The cards are fed into the machine by rollers—are first punched, then cut longitudinally by slitting rollers, and then sheared transversely by shears. The whole is moved by the action of a treadle. A press for pasteboard is described, in which the upper plate is in two parts, which are brought together or separate by a screw working a toggle joint.

William Brown, of Cambridge Heath, Middlesex, weaver, *for improvements in manufacturing elastic stockings, and other elastic bandages and fabrics.* Patent dated October 26, 1848.

This invention consists in weaving silk and India-rubber threads so as to form a circular fabric without seams. The India-rubber is deprived of its elasticity before it is woven, and the fabric is made three times the width of the finished size. It is exposed to hot air after it is woven, which shrinks it, and restores the elasticity.

Samuel Cunliffe Lister, of Manningham, in the county of York, gentleman, *for improvements in the preparing, hackling, and combing wool and other fibrous substances.* Patent dated October 19, 1848.

The patentee claims, in the first part, the passing or conveying wool, or other fibrous materials, through soapsuds, or other washing liquids, by means of endless cloths or aprons. In the second part; first, the application of lifting bars for the purpose of assisting the drawing the wool, &c., from porcupine drums, rollers, or sheets, either in the preparation of wool for combing, or after having been combed. Secondly, employing in preparing machinery, porcupine sheets or chains, either in combination with, or without, lifting bars, when the wool is not allowed to accumulate upon such sheets or chains, but is taken off by suitable rollers or other means. Thirdly, the preparation of wool, &c., for combing, in the manner described, where a motion, similar to the motion of the screw-gill, is obtained, without the intervention of a screw, and where the teeth are caused to enter and leave the wool near, or at right angles to, the fibres of the wool. In the third part, he claims, the constructing of a screw-gill, with a variable pitch of screw or worm, so as to cause a draught between the gills upon their entering the wool and their leaving it. In the fourth part, he claims, the constructing comb teeth with some of the back rows of teeth of not less than half an inch longer than the front row, when filled by any means other than by hand. In the fifth part, he claims, the construction of a machine described, for combing or hackling wool or hair; the mode of working of which is similar to that of the ordinary screw-gill, but without a screw, the teeth of the hackles being caused to enter and leave the wool or hair near, or at right angles to, the fibres; and also, travelling in a plane, horizontal, or nearly so.

John Wright, of Camberwell, Surrey, engineer, *for improvements in generating steam, and evaporating fluids.* Patent dated November 12, 1848.

The principle of this invention consists in applying heat to cellular vessels, containing a circulating medium, such as water, which medium conveys the heat to the fluid to be evaporated. The principle is shown as applied to a waggon boiler. Three longitudinal pipes extend underneath the boiler, and are connected together by smaller transverse pipes, all being exposed to the direct action of the fire, the longitudinal pipes being provided with stuffing boxes to allow of their expansion and contraction. A similar set of pipes is provided inside the boiler, and is connected to those outside. The heated water circulates through them, and they are provided with a safety-valve to allow of the expansion of the water, and a feed pump to renew any leakage.

The cellular vessels are proposed to be made of malleable cast iron or copper. Arrangements are described for marine and locomotive boilers.

John Davie Morris Stirling, of Black Grange, N.B., Esq., *for improvements in the manufacture of iron and metallic compounds.* Patent dated October 12, 1848.

The improvement consists in mixing malleable iron scrap with cast iron, by which the necessity of refining is obviated, and the strength of the metal materially increased. The scrap is put in the pig-beds, and the pigs so combined with the scrap are remelted and puddled to ensure perfect mixture of the metals. The patentee proposes to use from a fifth to a twentieth of scrap. Scrap steel may also be used to produce a superior article. Copper, tin, and zinc (in the form of calamine), manganese (and, in fact, nearly all the metals but gold and silver), are stated by the patentee to effect an improvement by using proper proportions.

An alloy, called "British Gold," is also described, composed of zinc, iron, copper, and manganese. This alloy is stated to roll and engrave well, and to form a substitute for gun metal, while it has the appearance of gold. A hard imitation of silver is described, composed of six parts of the alloy of zinc, ten of copper, and two of nickel.

John Ashby, of Carshalton, Surrey, miller, *for certain improvements in machinery applicable to cleaning grain, and dressing meal.* Patent dated October 12, 1848.

The first of these improvements consists in forming the rubbing surfaces of the cylinders of the smut machine of triangular bars, covered with interlaced strips of metal, whereby they are rendered much stronger and more durable. These cylinders are set vertically and a strong current of air is drawn up by a fan blast, which carries up the grain after being partially cleansed, and delivers it into a receiver, while the lighter dust is carried over another partition.

The second part consists of an improved dressing machine, in which the cylinder is placed vertically, and the flour is received on two shelves; the best on an upper shelf, and the seconds on a lower one. An exhausting fan draws up the flour. In applying this to the ordinary inclined cylinders, the brushes have a reciprocating motion given to them, and the cylinder, a slow rotary motion, and by this means the meshes of the cloth are kept free from the coagulated flour.

Richard Roberts, of Globe Works, Manchester, engineer, *for certain improvements in, and applicable to, clocks, and other time-keepers; in machinery or apparatus for winding clocks and hoisting weights; and for effecting telegraphic communication between distant clocks and places, otherwise than by electro-magnetism.* Patent dated July 11, 1848.

[This is an affair of such length and intricacy that we are compelled to content ourselves with indicating the outlines merely of the various details, for which we are indebted to the *Patent Journal.*]

This invention relates to improvements in the construction and arrangements of the mechanism or apparatus made use of to effectuate, and maintain with accuracy, the movements of clocks, chronometers, watches, and other time-keepers, parts of which improvements are also applicable for effecting telegraphic communication. and for other purposes, as hereinafter described; which improvements may be generally subdivided as follows:

1. To clocks and clockwork, which relate—

First: to certain novel mechanical arrangements, by which the influx and efflux of the tide are applied as agents for effecting, directly or indirectly (by hoisting weights for that purpose), the motions of clockwork, parts of which arrangements or modifications thereof, may be applied for hoisting weights for various purposes, in situations where the agency of the tide can be obtained.

Second: to the novel and effective arrangements in connection with turret and other public clocks, whereby the difficulty of placing the "guide pulley" at such a distance from the barrel, as will admit of an equal distribution of the cord or chain throughout its entire length is avoided; and by which arrangement two or more trains may be actuated, by one weight, and one cord or chain, the effect of which shall be equimotive at all times.

Third: to certain novel arrangements in connection with clocks and other time-keepers, by which the time shown by the dial at any particular clock, shall be also shown by dials at several places simultaneously, parts of which apparatus may be applied where telegraphic communication or intercourse by signals may be required.

Fourth: to certain novel methods of regulating the maintaining power, and thereby imparting equimotive impulses to the pendulum, and affording compensation for the effects which changes of temperature produce upon the rod of the pendulum.

Fifth: to certain novel apparatus, whereby the hands or indices of clocks, or other time-keepers are advanced at definite intervals of time, which intervals shall correspond with a certain definite number of oscillations of the pendulum.

Sixth: to the construction of, and application to, turret ond other clocks, of a transparent cycloramic dial or index; admitting of more effective and economic illumination, and possessing superior capabilities of communicating the time to observers at a greater distance therefrom, than the dials in ordinary use can do, either by night or day.

Seventh: to certain novel arrangements and apparatus, for striking the hours and quarters, to be substituted for the train or trains of wheels, commonly made use of for such purposes with clocks and other time-keepers, in ordinary service.

Eighth: to certain novel forms of escapements adapted to turret and other public clocks, to common and to skeleton house clocks, and to clock and time-keepers actuated by electro-magnetism.

II. Improvements in chronometers, relate—

First: to certain novelties in the construction of compensation balances, possessing greater stability, and adapted for more efficient service, than compensation balances of the ordinary kind.

Second: to a certain novel construction of escapement, whereby the motive power may be regulated so as to impart equimotive impulses to the balance, by the aid of which escapement the difficulty of setting the chronometer "to time," will be greatly reduced; and the agency of the fusee may be dispensed with at pleasure.

Third: in the adaptation of certain novel means whereby chronometers are enabled to beat dead seconds with the ordinary train of wheels only.

III. Improvements relating to watches, consisting—

First: in the application of certain novel means for regulating the motive power, so as to impart equimotive impulses to the balance, by the aid of which, the agency of the fusee may be dispensed with at pleasure.

Second: in the adaptation of mechanism for recording the duration of intervals of time, occupied by occurrences and events, the use of such mechanism in no wise interfering with the accurate time-keeping of the watch.

Third: in certain means of adapting watches to beat dead seconds, with the ordinary train of wheels only.

IV. And, generally, in reference to these improvements the invention relates—

First: to certain methods which he employs for effectually hardening, and for insuring accuracy in boring the frame-plates of clocks, watches, chronometers, and other time-keepers.

Second: in the novel apparatus which he makes use of, for correctly ascertaining the relative sizes of the pinions and wheels of clocks, watches, and other time-keepers to each other.

Robert Angus Smith, of Manchester, *for improvements in the application and preparation of coal tar.* Patent dated October 19, 1848.

The patentee claims the coating the interior of water pipes with coal tar, which he effects by cleansing the insides of oxide by any of the known methods, covering them with linseed oil, heating them to 300 degrees Fahrenheit, and then exposing them in a bath of coal tar. Linseed oil is poured into the pipes to remove any excess of the tar.

RECENT AMERICAN PATENT.

William P. Blake, New York City, *for an improvement in spring fish-hooks.* Patent dated August 15, 1848.

The patentee says—"The nature of my invention consists in making a spring hook, which when presented to the fish is *compact*, and can readily be taken into the mouth, which acting upon it, it is caused to expand, and the fish is hooked on two sides of the mouth."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of an expanding spring hook, with a catch without movable joints, bearings or slides, in such a manner as when set it occupies about the *same* space as an ordinary hook; also the confining of the hook in a set state, (so that *the biting of the fish* will spring it,) by means of a notch or projection on one limb or shank of the hook, into or on which the opposite limb or shank catches, all as set forth."

OSCILLATING ENGINES *VERSUS* STEEPLE ENGINES.

To the Editor of the Artizan.

Sir,

As I find, from your lists of new steamers, that our friends in the north are beginning to turn their attention to oscillating engines, I wish to make a few remarks on the supposed advantages which they are said to possess over steeple engines. I wish it, however, to be understood that my arguments are not meant to apply to large sea-going steamers, but to that numerous class of from 30 to 100-horse power, with which our rivers are so well supplied.

The first objection which is generally brought against steeple engines, is the projection of the steeple and guides above deck. Now (excluding sea-going steamers), what is the real value of the objection? What can be done with the space over the hatchways of a pair of oscillating engines? The only other part of the objection is the weight, which is raised above the centre of gravity; but this is comparatively so small, that I do not attach much importance to it. The second objection is, that the engines are out of balance, and that the alternate motion is disagreeably felt. This is due more, I believe, to the common practice of putting *one* steeple engine only, instead of a pair, rather than to the form of the engine itself: however, allowing that, in a pair of steeple engines, the unbalanced weight would produce an unequal motion on the up and down strokes, this can be remedied by putting two or three heavy floats on each paddle-wheel. With feathering-wheels, I doubt if even this would be necessary.

Thirdly, does the oscillating form possess any superiority in the consumption of steam? All the facts would seem to be in favour of the opposite opinion. I will admit that the pressure of the steam is as well maintained, and that there is no greater loss on the vacuum side in oscillating engines; but the passages are made larger to obtain that equality, and the loss of steam from their length, I have estimated, is not less than 5 per cent.: more surface is exposed to condensation, and all the advantage of draining the cylinder into the condenser, which the steeple engine possesses, is lost. These facts, I think, prove that the steeple engine will be as economical, if not more so, than the oscillating engine.

Fourthly, is the oscillating engine more economical in first cost?—I should say, no. The cylinder is a difficult and hazardous casting, and requires a superior class of tools and men to get it up.

Lastly, I am satisfied, from practical experience, that the oscillating engines give more trouble to the engine-men: on this point, however, I will say no more, for I have no doubt many of your readers are better qualified than myself to form an opinion. If my arguments, then, are not founded on error (and I am open to conviction), I think our engineers ought to pause before they make their choice. Let them improve their workmanship and design, if they can, but I believe they cannot improve their principle.

A. Draughtsman.

AN IMPROVED ELLIPTOGRAPH.

To the Editor of the Artizan.

Sir,

In your September number, page 205, there is an engraving with de scription purporting to be an improved Elliptograph; permit me to say that your correspondent "J. S." is in error, when he says this instrument describes a perfect ellipse; the fact is, it will not describe an ellipse at all, for the very same reason that the piston of a steam-engine is not midway in the cylinder when the crank is at right angle to the piston-rod.

I remain,
Yours truly,
N. D.

London, September 4th, 1849.

NINETEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Birmingham, September 12.

Section A.—Mathematical and Physical Science.

President—Mr. W. Hopkins, F.R.S.

Mr. Ronalds handed in his annual report "On the Kew Observatory," from which it appeared that the observations have, from the deficiency of applicable funds, been discontinued since the meeting in 1848; but a sum having been then voted for completing certain experiments in progress, and another sum for the reduction and discussion of the series of electric observations, which commenced in August, 1843, and terminated in 1848, the last year's work has been principally devoted to these objects, and it was deemed that good service has been rendered to the modes of magnetic investigation by this employment of the Observatory. The report proceeds to give an account, as usual, of the state of the establishment, including a complete inventory of the contents of the building. Then follows Mr. Birt's discussion of the electrical observations, occupying a much too large part of the volume to be read, and therefore left for Mr. Birt to report afterwards in substance. A summary specification of the experiments of the year was given, viz.:—1. On the management of the light admitted into Mr. Ronalds' camera by suppressing his usual condensing lenses, and bringing the index of the magnet nearer to the lamp, by which means the time required for producing an efficient image on the paper was materially diminished. An improvement on Count Rumford's polyflame lamp was useful for heightening the brilliancy of the flame itself. 2. Experiments intended to determine the comparative advantages of a slit in a shield and the index which had been hitherto used. The slit was found far preferable in the case of large and sudden excursions, such as those occurring in Canada. 3. On the comparative advantages of the Daguerreotype and Talbotype processes. The former was found for all these uses preferable, confirming Colonel Sabine's anticipations. 4. Several experiments, more or less successful, on modes of copying the impression of the mercury on the plate, in which assistance was derived from Mr. Malone. 5. Experiments of etching, either by the mezzotinto or dry-point method, on the Daguerreotype plate itself, with a view to the circulation of the original observations, the plate remaining serviceable for a few more mercurial impressions. 6. Experiments suggested by Dr. Lloyd for procuring on the plate the same kind of zero line for measuring ordinates as Mr. Ronalds had from the first procured upon paper, &c. 7. Experiments for the construction of an instrument for measuring ordinates of magnetic and other curves from the above-mentioned zero line, or in other instances. 8. Experiments for the improvement of Daguerreotype apparatus for the process of cleaning, polishing, and coating plates used for the purposes of these observations, with some other experiments of less consequence. The volume, further, contains the full details, illustrated with five plates, of the apparatus, resulting in part from the foregoing series of experiments, and sent by Colonel Sabine to the Toronto Observatory for immediate use. An advantage of this arrangement is, that no *hygrometric* expansion or contraction can have sensible effect on the required results. Mr. Ronalds' correspondence on the subjects of electricity and magnetism seems to have had beneficial results. In the last place is presented, as usual, a list of proposals for new experiments at Kew, extending to twelve heads, one of the most urgent of which Mr. Ronalds considers to be the prosecution of experiments commenced at the Observatory in 1845, and suspended for want of funds, on the important subject of *frequency of atmospheric electricity, a subject unaccountably neglected since the observations of Beccaria, at Turin, in the middle of the last century*, and one which seems to Mr. Ronalds to grow in importance with the growth of our chemical and magnetical information. Others of these proposals embrace a course of inquiry in magnetism, electricity, and various meteorological phenomena, all requiring only a sufficient observatory staff to be beneficially carried out.

"Report on the Discussion of the Electrical Observations at Kew," by W. R. Birt.—The author stated that 15,170 observations of atmospheric electricity, made during a period of five years, contributed to the deduction of the results detailed in the report. Of these, 14,515 were positive and 655 negative. The positive observations had furnished the data for determining the ordinates of the diurnal and annual curves of atmospheric electricity, especially during the three years, 1845, 1846, and 1847, to which 10,176 observations contributed. The result of the discussion with reference to the diurnal curve is as follows:—From the mean of the three years at each observation hour—viz., every even hour, Greenwich mean time, throughout the day and night—it appeared that the tension of atmospheric electricity is at a minimum at 2 o'clock in the morning; from this hour a gradual rise takes place until 6 a.m., after which hour the tension rises rapidly, the value at 8 a.m. being nearly double of that at 6 a.m.; the increase is then more gradual until 10 a.m., the epoch of the first or forenoon maximum; from this hour the tension gradually declines until 4 p.m., when its value is but slightly above the value at 8 a.m. This second minimum the author terms the *diurnal* minimum, as distinguishing it from the *nocturnal* at 2 a.m. After this the tension rapidly increases until 8 p.m.; and after a slight rise to 10 p.m.—the epoch of the principal or evening maximum—the upward course of the tension is completed. The evening maximum is rather considerably elevated above the forenoon maximum at 10 a.m. Between the hours 10 p.m. and midnight the tension declines to nearly the value of the nocturnal minimum. In treating of the annual period, the author remarked that the lowest tensions are exhibited in June and August, the tension of July being rather *above* that of either of the before-named months. During September a small rise occurs, which is increased in October; the augmentation becomes more rapid from November to January, and then receives a check, the February increment being less than either of those of December and January. In February the maximum is attained; it is succeeded in March by a very rapid diminution of tension, which continues through April and May, the decrements becoming less in value until June, the month presenting the lowest tension. In connexion with this part of the report, the author solicited attention to the close connexion which appears to exist between the electric tension and the humidity of the atmosphere; the records of the Observatory at Greenwich furnishing the means of comparing the two elements. With respect to the diurnal period, the author also infers that the higher tensions exhibited by the electrometers are more or less connected with the humidity of the atmosphere, especially the moisture enveloping the collecting lanthorn. With the view of illustrating this point, he divided the entire series of observations into two sets—one of high, the other of low tensions, as well as specifying in each division the summer and winter observations—and found that the high tensions in the winter materially influenced the results deduced from *all* the observations in the winter, and those again materially influenced the results appertaining to the entire year. The correspondence between these results and those of the discussion of the annual period tended greatly to confirm his inference that the positive tensions, especially those of a high value, are more or less due to the humidity present in the atmosphere. The discussion of the observations at sunrise and sunset, 3,367, illustrates, to a great extent, the annual period. As these observations extend over a period of five years, the curves are more regular than that deduced from the

observations of three years. In accordance with the results having reference to the diurnal period, the sunset curve is found to be superior to the sunrise—*i. e.*, the electric tension is higher at sunset than it is at sunrise. In the sunrise and sunset curves the maximum occurs in January instead of February; in other respects there is considerable accordance between the annual periods. In discussing the negative observations the author pursued altogether a different course—the occurrence of negative electricity as compared with positive being rare. He first assembled all the cases of negative electricity that occurred in the seventeen months prior to 1845, and compared each observation with the records for the same period at the Observatory, Greenwich. The principal results of the comparison are—first, that when the conductor has been negatively charged, rain, generally heavy, has mostly been falling; the instances when rain has not fallen, the charge being negative, are very rare—only 10 out of 231; second, these ten instances, with the assistance of the Greenwich observations, have enabled the author to infer that the negative charge is derived more immediately from the cloud precipitating the rain—a particular kind of cloud, cirro-stratus, in almost every instance having been observed at Greenwich when the conductor has been charged negatively at Kew. From this he apprehended the possibility of obtaining a diurnal period of negative electricity more or less in accordance with the diurnal period of cloudiness; and with this view he discussed the remaining 424 negative observations. The result is perfectly in accordance with that of the discussion of the preceding seventeen months; the greater occurrence of negative electricity, as well as its increase of tension, coinciding within certain limits with the greatest development of cloud, the epoch being about the middle of the day. The results of the entire discussion cannot be better expressed than in the words of the concluding portion of the report:—"In both instances (the positive and negative) the humidity and cloudiness precede the electricity, and strongly indicate that, whatever relation may exist between the development of positive electricity and humidity on the one hand, and that of negative electricity and cloudiness on the other, such relations are not only likely to be of very constant character, but that a similarity exists between the two sets of phenomena which goes far to show that the nature of their connexion, if any, is also similar: the one, viz., positive, principally indicating the electric tension of aqueous vapour; the other, viz., negative, the electric disturbances produced by the sudden precipitation of this vapour when existing as cloud."

"On the Orbitual Motion of the Magnetic Pole round the North Pole of the Earth," by the Rev. J. Grover.—This was shown by tracing the positions of the magnetic pole at several intervals during the last 250 years, by converging lines drawn from the London, Paris, and St. Petersburgh observatories, and deduced by computations of the different variations of the magnetic needle at these places. These changes were shown very distinctly upon the different polar horizon of the observatories, and the orbit drawn from them in its proper position. An extraordinary acceleration of this motion from 1580 down to 1723 was pointed out, and a pause at that period, which indicated a climax in that year, in which both the horizontal movement of the needle was suspended, and the dipping motion changed its course from a downward to an upward motion. Mr. Grover showed also a series of changes in the lines of equal declination about the isodynamic poles, which appeared to indicate a direct tendency, or attractive force operating upon the magnetic needles from the poles; which he assumed and showed to be sufficient to account for the extra linear position of the lines of no declination between Europe and Asia, as well as for the extraordinary curvatures of the declination lines observed in the north of Asia on the two sides of the isodynamic pole, and on the origin and changes of the closed systems or ovals in the Asiatic and Pacific allocations. Mr. Grover regarded the moving magnetic pole in the light of a satellite, or supplemental system, to the isagonal poles, disturbed by the accumulation of ice about the poles in the course of a long series of ages, and generated as a compensative process from an interruption of the original system.

"On a Rainbow seen after Actual Sunset," by Professor Chevallier.—On the first of July 1849, at Esk, near Durham, I observed a rainbow, which continued to be visible after the setting of the sun's complete disc. The latitude of the place has been determined accurately by Bessel's method of observing the transit of stars over the eastern and western prime vertical; and assuming the horizontal refraction to be 33′, the time of the settings of the sun's upper limb was 8h. 36m. 2s. The time of sunset could not be observed in consequence of clouds. At 8h. 31m. 43s. the bow seemed to be a portion of a circle greater than a semicircle, like a Saracenic arch, both the northern and southern portions being visible to an altitude of about 40°. At 8h. 34m. 43s. the southern end had faded, but the northern end and a part of the secondary bow were visible at about 5° of altitude, the sky being visibly darker between the primary bow. This continued visible till 8h. 37m. 48s., 1m. 48s. after complete sunset; and as late as 8h. 38m. 43s., 2m. 41s. after sunset, an irregular portion of the bow was visible at an altitude of about 45°. The time was accurately known by comparing the watch with a transit clock immediately after the observation. In order to account for this appearance, it must be supposed either that the horizontal refraction was much greater than usual, or that the bow was formed at a very elevated region of the atmosphere.

"On Luminous Meteors," by Prof. Powell.—This was an extensive collection of facts collected from numerous observers, forming a continuation of the report on this subject drawn up last year by Prof. Powell at the request of the Association. In each case the exact circumstances attending each meteor were given accurately, frequently as seen in several places at the same time; the periods of showers of meteors at given times of the year, were given in some instances from separate observations. Meteors seen by day passing between the observer and the earth, were in some cases recorded; these were supposed to be in some instances the cause of unusually cold days. Those which were suddenly extinguished as if being previously illuminated by the sun and at an instant ploughing into the shadow of the earth, were much attended to as giving assistance to the researches of Sir John Lubbock, and other investigators of this subject.—Several members of the Section gave examples of meteors which came under their notice, and expressed their hope that this communication should be printed at length in the Report.

"On Meteors," by Mr. Lowe.—This communication formed a continuation of the previous one, and Prof. Powell expressed his intention to incorporate it with his Report.

"On Shooting Stars," by Mr. Birt.—This also formed a continuation of the same subject. Several of the observatians were accurately projected, and the important circumstances of all carefully noted.

"On a Notice of a Meteor seen in India on the 19th of last March," by Admiral Sir C. Malcolm.—This consisted of selected notices of the meteor from the *Bombay Times* of March and April, and contained several letters detailing the circumstances under which it was seen by the different writers; from which it was inferred to be a mass of over 600 feet in diameter; and the place at which it fell after bursting was ascertained to a high degree of probability: it fortunately was not an inhabited place.

"On Teaching Perspective by Models," by Mr. Twining.—Mr. Twining exhibited models, and demonstrated by figures drawn on glass, the importance of having the perspective plane selected in a proper position to the several groups to be embraced in the picture, and the distance of that plane properly proportioned to the breadth of the picture.

Section B.—Chemistry, including its Applications to Agriculture and the Arts.

"On the combined use of the Basic Acetates of Lead and Sulphurous Acid, in the Colonial Manufacture and the Refining of Sugar, by Dr. Scoffern."—Dr. Scoffern, after a few preliminary remarks on the anomalies which beset the colonial sugar-manufacturing functions, stated the actual amount of pure white and crystallizable sugar existing in the sugar-cane juice to be from 17 to 23 per cent., and the amount of juice contained in the cane to be about 90 per cent.: of this amount only 60 per cent. on an average is extracted—and of this quantity only one-third part of its sugar is obtained, in a dark impure condition, instead of white and pure as it might be extracted. The operation at present generally followed in the colonial production of sugar involved the use of lime, an agent which, although beneficial in separating certain impurities and decomposing others, effects both these agencies at the expense of two-thirds of the original sugar. Curious plans had been followed to avoid the use of lime—alumina, in its hydrated condition, had been employed, but with inconsiderable success. As a purifying agent the basic acetate of lead was known to be most potent, but could not be generally employed, owing to the existence of no

sufficient means of separating any excess of that agent which might remain. Dr. Scoffern effects this separation by means of sulphurous acid forced by mechanical means into the sugar solutions. The process had been used for more than twelve months in one of the large British refineries, and a lump of sugar prepared by means of the operation was exhibited. The advantages presented by this operation were thus summed up :—1. As applied to cane-juice, and other natural juices containing sugar, it enables the whole of the latter to be extracted instead of one-third as is now the case: and in the condition of perfect whiteness, if desired, without the employment of animal charcoal. Owing to the complete separation of impurities, the juice throws up no scum when boiled, and therefore involves no labour of skimming. Finally, the process of curing is effected in less than one-third of the present time; and the quality of the sugar being in all cases so pure and dry, no loss in weight occurs during the voyage home. 2. As applied to the refinery operation, it enables the manufacturer to work upon staples of such impurity that he could not use them on the old process. It yields from these staples a produce equal in quality to the best refined sugars produced heretofore—in larger quantity, and in less time. It banishes the operation of scum-pressure, the employment of blood and lime. Finally, its cost is even less than that of the present refinery process.

Dr. Miller remarked that it had been objected that sulphurous acid absorbed oxygen, and passing into sulphuric acid impaired the grain of the sugar. Dr. Playfair said it had been stated that sulphurous acid gave a taste to the sugar. Dr. Scoffern observed that his specimens proved that neither of these objections was valid. It having been asked if voltaic electricity had been found successful in removing the salts of lead from the sugar in Dr. Scoffern's process, Dr. Faraday expressed his opinion that it was impracticable. Professor De Vry thought the molasses would contain acetate of lime which would be unfit for the uses to which it is put in Holland.

"On the presence of Fluorine in the Waters of the Firth of Forth, the Firth of Clyde, and the German Ocean," by G. WILSON, M.D.—In 1846, the author announced the discovery to the Royal Society, Edinburgh, of fluorine as a new element of sea water. He was led to search for it, after observing that fluoride of calcium possesses a certain small but marked solubility in water, which explains its occurrence in springs and rivers, and necessitates its occasional, if not constant presence, in the sea. The only specimens of sea water he had examined before this summer, were taken from the Firth of Forth, at Joppa, about three miles from Edinburch. He obtained the mother-liquor or bittern from the pans of a salt-work there, and precipitated it by nitrate of baryta. The precipitate, after being washed and dried, was warmed with oil of vitriol in a lead basin, covered with waved glass having designs on it. The latter were etched in two hours, as deeply as they could have been by fluor-spar treated in the same way, the lines being filled up with the white silica, separated from the glass. The author has recently examined in the same way bittern from the salt-works at Saltcoats, in the Firth of Clyde, but the indications of fluorine were much less distinct than in the waters on the East Coast. On procuring, however, from the same place, the hard crust which collects at the bottom and sides of the boilers used in the evaporation of sea-water, he found no difficulty in detecting fluorine in the deposit. This crust or deposit consists in greater part of sulphate of lime, and of carbonate of lime and of magnesia, but it contains also much chloride of sodium, and the other soluble salts of sea water, entangled in its substance. When sulphuric acid, accordingly, is poured on it, it gives off much hydrochloric and carbonic, as well as some hydrofluoric acid, and the latter is thus swept away before it has time to corrode the glass deeply. The author preferred, nevertheless, to use the crust exactly as he got it, that the proof of the presence of fluorine might not be impaired in validity by the possibility of that substance being introduced by the water or re-agents, which must have been employed had the chlorides and carbonates been separated from the crust by a preliminary process. The crust, accordingly, after being dried and powdered, was placed along with oil of vitriol in a lead basin covered by a waxed square of plate glass, with letters traced through the wax. A single charge of the crust and acid corroded the glass very slightly, but by replenishing the basin with successive quantities of these materials, whilst the same plate of engraved glass was used as the cover, he found no difficulty in etching the glass deeply. Operating in this way, he has found fluorine readily in the boiler deposit from the waters of the Firths of Forth and Clyde. It is a less easy matter to subject the waters of the open sea to the requisite concentration, before examination. It occurred to the author, however, that the incrustations which are periodically removed from the boilers of the ocean steamers would serve to determine the question whether fluorine is a general constituent of the sea. He made application, accordingly, at Glasgow and Leith for the deposits in question. It appears, however, that the deep-sea steamers which leave the former have their boilers cleaned out at other ports, so that he has as yet been unsuccessful in procuring crusts from the west coast of Scotland. He has obtained at Leith the crust from the boiler of a steamer called the *Isabella Napier*, which trades between that port and Wick, so that the greater part of the water consumed as steam by its engines is derived from the German Ocean, although a portion is necessarily obtained from the Firth of Forth. The crust from the boilers of this vessel was treated in the way described, and at once yielded hydrofluoric acid. A single charge, indeed, of the materials marked the glass distinctly, and four charges deeply. We may therefore infer that fluorine is present in the waters of the German Ocean, for different portions of the peposit yielded it readily, and marked glass as deeply as the deposit from the water of the Firth or Forth did, which could not have been the case if the whole crust had not contained fluorine pretty equally diffused through it. From what is known of the comparative uniformity in composition of sea water, it may safely be inferred that, if fluorine be present in the waters of the Firths of Forth and Clyde, and in the German Ocean, it will be found universally present in the sea. Mr. Middleton, before 1846, came to the conclusion that fluorine must be present in sea water, since it occurred, as he had ascertained, in the shells of marine mollusca. Silliman junior, without a knowledge of Middleton's views, drew the same inference from its invariable presence in the calcareous corals brought to America by the United States expedition from the Antarctic Seas. The author has found fluorine abundantly present in the teeth of the Walrus, which points to its existence in the Arctic Ocean; and it seems so invariably to associate itself with phosphate of lime that it may be expected to occur in the bones of all animals marine and terrestrial. The author has found fluorine likewise in kelp from the Shetlands, but much less distinctly than he anticipated. Glass plates were only corroded so far as to show marks when breathed upon. Prof. Voelker, also, was kind enough, at the author's request, to search for fluorine when analysing the ashes of specimens of the sea pink (*Statice Armeria*), which had grown close to the sea shore, and contained iodine, and found fluorine in the plant. When all those facts are considered, it is not too much, the author thinks, to urge that fluorine should now take its place among the acknowledged constituents of sea water. He has entered at length into the consideration of the natural distribution ef this element, and into other details connected with it, in a paper in the "Transactions of the Royal Society of Edinburgh," vol. xvi. part 7, and in a communication made to the Association at its Southampton meeting. The The *Statice Armeria* may certainly be added to the list of plants containing fluorine, and so may the *Cochlearia Anglica*, in specimens of which obtained from the Bass Rock, and analysed in Dr. Wilson's laboratory, Dr. Voelker has also detected this element.

Specimens of etched glass were shown to the section in illustration of this communication.

Prof. FORCHAMMER confirmed the results of Dr. Wilson. He had examined sea water from near Copenhagen, and found fluorine in every instance. He had also examined many shells and marine products from various localities, and they all gave the same body—the quantity of which was always greater in sea than in land animals. Mr. Pearsall thought he had detected fluorine in many waters from springs and rivers.

(To be continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 17th, 1849.

S. V. MERRICK, President, in the chair.

Dr. B. H. Rand presented a specimen of a substance which has recently attracted considerable attention. It is a heavy liquid, not miscible with water, resembling olive oil in appearance, being, however, rather more yellow and less translucent. It is inflammable, burning with an explosion like that of slightly damp gun cotton. When pure, it is stated to be inodorous. It is highly poisonous, a small fraction of a drop producing dis-

tressing and even alarming symptoms. Its chemical character was yet to be studied, and no test or antidote has, so far, been discovered for it. It was discovered by M. Sobrero, a Spanish chemist, and more recently made the subject of a paper by Dr. W. F. Jackson, of Maine, in the *Medical Examiner* for May. It is prepared by adding, cautiously, a syrupy solution of glycerine to a mixture of nitric and sulphuric acids. If the mixture be not made slowly, and the whole kept cool, an explosion takes place, and a substance resembling burnt sugar remains, of which a specimen was exhibited.

Dr. Rand exhibited to the meeting specimens of shot made by a new process, patented by David Smith, of the city of New York. The plan of Mr. Smith is to use an iron tube of 50 feet in height, in place of the ordinary towers of 150 feet. By the old process, great height was necessary to enable them to make all sizes of shot, for the reason that the shot must be cooled to a certain point before entering the water receiver below, and it could only be so cooled by contact with the necessary amount of air to which to impart its heat while falling. In the process of Mr. Smith, a current of air is made to ascend the tube by means of an ordinary fan, the amount of air used being in proportion to the size of the shot. By this method the elevation of lead for the largest sizes is reduced 100 feet, the cost of immense towers is dispensed with, and a common sheet iron tube of about eighteen inches diameter made to answer its purpose. Mr. S. is daily manufacturing at his store in New York, where any one may witness the operation.

SUGAR CULTIVATION IN INDIA.

The following interesting particulars regarding the abandonment of the cultivation of the sugar cane under European superintendence, by Messrs. Arbuthnot and Co., of Madras, are taken from the *Madras Athenæum* :—

"A fact of striking importance to the commercial interests of Europe and India has been elicited within the last month, in the abandonment, by the Messrs. Arbuthnot, of their great experiment of cultivating the sugar cane under European superintendence. For many years they have been the most extensive manufacturers of sugar in Southern India, converting to the extent of thousands of tons annually the coarse jaggery made by the ryots, into the refined product which finds its way into the market; but the attempt to raise the cane was first tried about two or three years since, and is needless to say that no cost or skill was spared to render it successful. Planters were brought from the West Indies at liberal salaries to direct the cultivation, and machinery of the most complete and extensive character was imported from England to irrigate the soil and manufacture the sugar on the spot. No project could possibly be set on foot under circumstances more favourable, but the upshot is that the land taken in Rajahmundry and Dowlaishwarum has been relinquished, and the cattle turned into the fields of standing cane. The doors of the factory are bricked up; the planters are discharged, and the operations of the eminent firm, to whose spirit of magnificent enterprise we owe the interesting example which promised such valuable results, are again restricted to the work of making sugar from jaggery, purchased from the native growers. The loss sustained by the failure of the scheme can be of no consequence to Messrs. Arbuthnot, but the experience which they have gained is of great consequence to the public, who have now the means of getting at a more accurate knowledge of the real conditions upon which sugar can be profitably made in this part of the world.

"We have expressed on former occasions a belief, that European machinery could never be used with advantage, where the staples of the country are to be operated upon, so long at least as we remain chiefly dependent upon native labour to keep it going, but we are inclined to go farther, and assert, that certainly so far as regards the growth of sugar, and probably so far as regards the growth of cotton, the Indian ryot has long since adopted the best methods of cultivation, with reference to the circumstances of soil and climate. It certainly does seem to the man who looks round upon the Western world, and contemplates the mighty achievements of combined skill and industry, a preposterous notion to advance, that a poor unaided peasant, who tills with the rudest implements, a little patch of ground, and then at harvest time expresses the juice of his handful of canes, in earthen vessels in the open fields, should be able to compete successfully with the English merchant, who is backed by exhaustless skill and unlimited means, but the fact nevertheless exists, and the common ignorance of it, works much mischief. It may be, that in future times we shall find out, that we have too systematically undervalued the native genius, and have not judged wisely in estimating their capacity, and general understanding of natural affairs, by the standard of their religious absurdities. It is true that their civilization is stationary, but for all that its products are not to be despised, and though we are usually supposed to be their teachers, yet there are occasions when the present relation of master and pupil might be reversed with advantage.

"It is very likely that, in certain good seasons, and with cheap superintendence, and limited expenditure in the item of machinery, a large tract of canes might be cultivated with much greater advantage than the natives are able to carry on in what may be truly called their garden culture of the plant; but we must bear in mind that the man who employs a large capital in growing sugar insures, as it were, the labourer on his estate against the visitations of storms and bad harvests; whilst the mere refiner, who deals only in the realised material, suffers at the most to the extent of losing for the time the interest of the money expended in erecting his machinery and buildings. In the one case, the capitalist has to bear all the loss: in the other, it is the people upon whom the burden of calamity falls most heavily. It is established beyond a doubt, that the business of converting jaggery into sugar affords, one year with another, very lucrative returns, the rate at which the cane juice is obtained from the ryots leaving the manufacturer quite safe from the hazard of losing, even at the lowest point of the market at home; but it is very questionable if the growers obtain even Cooly wages for the time which they have actually spent in the abour of cultivation. They are content to bestow upon their small fields a degree of care and industiy which could not perhaps be exerted under any circumstances upon an extended scale. The injury to the canes incurred in the latter instance, from the giving way at the roots, through the loosening of the earth consequent upon the continual irrigation, is guarded against by the ryot, who takes his bundle of hereditary bamboos, and with the aid of a crowbar, fences round his crop, securing the plants as a gardener secures his vines. It is evident that such a system of cultivation must tend to give the ryot a superiority over the large proprietor, so far as the amount of product on a given area is in question, and if we set off the weight of this fact against the advantage to be derived from the application, on the other hand, of European capital and skill, it becomes after all very doubtful if the balance does not lie in favour of the native. The question of competition to be maintained on the existing system with the West Indies and the countries in which slave labour prevails, must rest for future consideration. At present we have arrived at the important conclusion, that, under the most favourable circumstances, we cannot hope to alter the present mode of cultivating the sugar cane in Southern India."

ANALYSIS OF BOOKS.

Form and Sound: can their Beauty be dependent on the same Physical Laws? By Thomas Purdie. 8vo. pp. 112. Black, Edinburgh.

The title-page alone of this book would warn us of the dangerous ground on which we are treading, and a perusal of it only tends to increase our caution in venturing into such a "pretty quarrel" as is here disclosed. The case stands about thus, as far as we can learn. Mr. Hay, the author of "Principles of Symmetrical Beauty," and other papers, communicated to the Royal Scottish Society of Arts, has, by circulars sent to the members, and by advertising, charged Mr. Purdie with the high crime and misdemeanour of "having endeavoured to bring before the public, in an unusual way, and under a disguised title, a laboriously got-up series of misrepresentations," concerning the said papers. This volume is intended, it seems, as a clincher on this "serious charge, amounting, indeed, to one of wilful and malicious falsehood," and, as far as the force of ridicule can go, the task is performed very effectually.

It would occupy too much time, and above all, be foreign to the purpose of the *Artizan*, to enter into a metaphysical discussion of the laws of beauty

—a subject which has engaged the attention of the most subtle reasoners in all ages, from Plato downwards. We must be content to indicate the particular channels into which this dispute has flowed, leaving it to our readers to follow up the question if they please. We quote Mr. Purdie:—

"The theory I have undertaken to refute is based on the supposed existence in the human mind of a mathematical faculty, which produces a response to every development in external nature of the numerical ratios which regulate musical harmony. These ratios are assumed to be a universal 'homogeneous principle existing in external nature, to which this internal sense,' or mathematical faculty, 'responds;' the response constituting the emotion of beauty. Thus, the science of music is founded on the use of chords, the notes composing which bear to each other a certain mathematical proportion in the number of vibrations requisite to produce them. A certain amount of tension being supposed, a string vibrates slowly in proportion to its length, and as it is shortened, the vibrations become more rapid, and the sound more acute. Suppose the note C, the second space on the bass clef, to be produced by 256 vibrations in a second—512, or exactly the double, would be required to produce the octave above it. This sound would be obtained by using a string half the length of the other, the thickness and tension being equal. As, therefore, the longer of the two strings vibrates once in the 256th part of a second, and the shorter twice during the same space of time, the higher note stands to the other, in the number of its vibrations in the ratio of two to one. * * * * It is the object of the theory under discussion to apply these and the other ratios which form the foundation of musical science, to objects which address themselves to the sense of sight. The method generally adhered to in making this application, is by the use of angles, bearing to each other, in the number of their degrees, the same harmonic ratios already explained. In proportioning the façade of a building according to these principles, the spaces between the columns are supposed to be formed into rectangles, placed perpendicularly. An imaginary line, called the diagonal, is drawn from one of the upper angles of each rectangle to the opposite under one. The columns themselves, and all the other spaces and details, are formed into rectangles in this manner and similar diagonal lines are supposed to be drawn. The nature of the angles formed by these imaginary diagonal lines, with their bases, is the foundation of this supposed harmony. Thus, let a squure, the diagonal of which is 45°, represent the key note C, the other notes of the common chord, E, G, and the octave C, will be represented by rectangles, the diagonals of which form, with their longest sides, angles of 36′, 30°, and 22°, 30′, respectively. It is held that all rectangular figures used in combinations, ought in the degrees of their angles, to have to the square, and to each other, the same ratios as the notes of the musical scale, and that every departure from these ratios produces deformity identical with discord in music. 'The first principles of beauty are consequently' said to be 'the harmonic ratios.' Their mode of influencing the mind is explained, as follows:—'This effect upon the subject,' we are told, referring to the influence of any object on the senses, 'results from a homogeneous principle existing in external nature, to the operations of which the internal sense responds. This response is called perception, and the science of æsthetics is devoted to the investigation of the modes in which external objects—natural and artificial—affect this power of the mind. Although the organs of sense are various, yet the mode in which they act appears to be uniform, and of a mathematical nature; so that the effects of the object upon the subject, *i.e.* the effects of the objects of external nature on the mind), 'are either harmonious or discordant, according to the degree in which this principle is exhibited and responded to.' This 'internal sense,' which is elsewhere styled a 'universal mathematical principle of harmony,' may be taken, then, as the foundation of the theory. We are informed that this mathematical principle—*i.e.* the principle of the harmonic ratios—governs æsthetics, as the principle of truth governs morals, and that 'it will therefore be in the ratio of a general diffusion of a knowledge of their first principles that we will (shall?) be able properly to appreciate and practise the arts of design."

Mr. Purdie proceeds to analyse the authorities quoted in defence of this theory. Plato is pronounced unfathomable—Vitruvuis, incorrect in his facts. An amusing instance is quoted of the extent to which pre-conceived ideas will lead a mind, otherwise enlightened. Locke, in his essay on the understanding, mentions an eminent musician, who believed that God created the world in six days and rested the seventh, because there are but seven notes in music. Even Hughens, after discovering a satellite near Saturn, declared it was impossible that any more would be discovered, as this made up exactly (the proper harmonic number) the number of the planets. Our author argues, very felicitously, that if the theory be correct, there can be no reason why the sense of hearing alone, should be appealed to. "If the phenomema connected with hearing favour the theory, those of the other senses—taste, smell, and feeling—are against it. But, indeed, our sense of the beauty of form seems to have much more in common with the sense of taste than with that of hearing. The names are in all languages identical of the principles of the harmonic ratios exercise, as they are said to do, "a controlling influence over all the combinations throughout the great system of nature," then the combination of cookery cannot be left out of the category. If the mode in which the senses act be "*uniform and of a mathematical nature*," and our perception merely the response of our internal sense to the development of an *external mathematical principle*, as it is called "*a homogeneous principle existing in external nature*," then it clearly follows, that a man does not relish apple dumpling simply because it is agreeable to his palate—a reason which stops all further inquiry—but because sugar, forming an angle with its base of 45 degrees, while acidity forms one of 30 degrees, sour stands to sweet in the ratio of 2 to 3, and the variety being equal to the uniformity, the result is harmony!!

We cannot afford space to follow Mr. Purdie into his analysis of the theory as applied to the human form, &c., but if our extracts tempt any of our readers to pursue the subject, they will find ample materials for cogitation in this very "smart" volume.

BUILDING ARTS.

SPECIFICATION OF THE CONTRACT FOR THE ERECTION, OF THE NEW ROYAL EXCHANGE.

(Continued from page 214).

GLAZIER AND METAL WORKER.

To glaze all sash doors, sashes, fanlights, and skylights throughout, as shown in the other drawings, and described with the other works. All glass in the basement, and in the second story, not otherwise described, to be second crown glass. All other glass to be partly sheet glass of the best quality, commonly called patent flattened sheet glass, which is to weigh not less than 19 ounces the foot, superficial; partly unground plate glass; partly plate glass ground on one side only; and partly polished plate glass, as is more particularly described in the other parts of the specification. The glass used to sashes which are circular on the plan, to be properly bent to the required curves.

To provide and deliver to joiner, to be fixed by him, a patent 9-inch glass illuminator.

To provide and fix in iron frames six patent glass illuminators, 18 inches diameter.

To provide and fix all the copper and metal skylights and sashes described with the other trades. The copper bars to be solid drawn bars.

The openings for light in the great span roof, west end, to be glazed with unground plate glass, 42 sheets 48 in. by 34; four sheets 55 in. by 34; and ten sheets 48 in. by 18. The joints to lap two inches, and the edges and meeting surface to be ground to form a close lap-joint.

To provide and fix extra metal work beyond what is shown and described, to the extent in value of £100; and also, in addition thereto, extra glazing beyond what is shown and described, to the extent in value of £100.

PAINTER.

All woodwork to be knotted twice. Generally, all work to be properly prepared for painting. The materials used to be all of the first quality; the work carefully executed, properly stopped, and pumiced between each coat.

To paint all bolts, straps, and wrought iron work used in the carpentry, and all cast iron work not covered, with three coats of oil colour. The cast iron beams, bearers for arches, and similar castings, which will be covered in, to be painted with lithic paint, as described with the smith's work.

To paint all railings, gratings, iron guards, and sashes, the iron staircases, the metal skylights, and all other ironwork and metal work, four times with oil colour. To paint in a similar manner the stone chimney pieces.

To prime, and, in addition thereto, to paint four times in oil colours all wook work usually painted; to be finished fair with some plain tint, including all woodwork provided to be done to a given extent in quantity, but not that which is provided in extent in value. To paint five times in oil and, in addition, once in flatting, with a plain colour, all stucco walls, toge-

ther with all panel work, all mouldings, all mastic plinths, and the twenty-four decorated window and panel heads in Lloyd's room; also all other plaster work described and provided to be done to the sides of these rooms.

To paint five times in oil only the cemented sides in water-closets, urinals, and other parts adjoining.

To varnish twice, with the finest copal varnish, all the wainscot wood-work, so as to produce, when finished, a polished hard surface, including all handrails, and all sashes, frames, and beads.

To bronze the ornamental iron work, and other work, to the extent of 2643 yards superficial; also balusters and bars, in addition thereto, to the extent of 17,451 feet lineal.

To grain extra, in imitation of wainscot or oak, and varnish twice, as described for the wainscot wood work, sundry parts of the work which will be directed by the architect, to the extent of 3,000 yards superficial. Two-thirds in quantity of this work to be plain good graining; the remainder to be executed in the most perfect style.

The contractor to execute other painting, more than is shown and described, to the extent in value of £100.

Those parts of the work to be done for which specified quantities and values are given, are to be examined and measured, and the variation, as in the case of the other work, valued and allowed either way, according to the conditions of the contract.

ADDENDA.

The contractor to give notice to the district surveyor, and to pay him his fees of £42 when the roofs are completed.

The contractor, when he takes possession of the ground, is to pay the yeoman of the channel £19 6s., and he is to pay also a similar fee in amount at the end of every twelve months afterwards, until the hoard is removed.

The contractor to reinstate, alter if needful, and maintain, the present hoard, until the completion of the works.

The contractor to provide and keep one gate-keeper and one watchman during the progress of the works, and he is also to provide and keep in repair a watchbox for them.

The contractor to execute works necessary for the finishing of the porters' room in Ambulatory, beyond the door, which is before described, to the extent of £20.

The contractor to cart away all superfluous earth and rubbish from time to time, during the progress and at the completion of the works.

The contractor is to make copies of all the contract drawings, and of the working drawings, from time to time, for his own use, as the original drawings will remain with the clerk of the works.

N.B. The dimensions for cisterns, expressed in the former parts of this specification, are the dimensions inside of the cisterns, not outside.

17, *St. Helen's-place.* WILLIAM TITE.

CHESTER AND HOLYHEAD RAILWAY—BRITANNIA BRIDGE.

As considerable public misapprehension appears to exist as to the causes and consequences of the accident at the Britannia-bridge, which has delayed the operation of raising the tube, and of which no authentic details have hitherto been published, the following extracts from the evidence given by Mr. Clark at the inquest on the body of Owen Parry, who was killed by the accident, will be read with interest:—

"Menai Bridge, Aug. 18.—Mr. W. Jones, coroner, Edwin Clark, being sworn and examined, deposed as follows:—I am resident engineer of the works at the Britannia-bridge, and am acting under Mr. Robert Stephenson. I superintend the whole of the iron work. I was upon the works yesterday (the 17th of August). We were raising the tube. The deceased was not engaged in the operation of raising the tube. We were raising the Anglesea end of the tube by means of an hydraulic press. It was 20 inches in diameter inside; the thickness was about 10 inches. It was about 10 feet long. We were forcing water below the piston of the press with a steam-engine, which, raising the piston drew up the tube after it. The weight was about two thousand tons. The pressure on the circular inch in the press is about 27-10 tons. We had ascended 2 feet 4 inches, when the bottom of the press suddenly separated from the body of the press and fell, together with the water contained in the press, on the tube beneath. The crosshead of the press, on which I was standing, descended about 2 feet 4 inches, and I was thrown on to the boiler of the engine-room. I saw the deceased, with other men, come along the top of the tube, and ascend a rope-ladder about 100 feet immediately beneath me, and immediately afterwards I saw the body of the deceased lying upon the tube just under the press. The portion of the press that fell was, I should say, about 1½ tons weight. It must have struck the rope-ladder on which the deceased was ascending, and then fell upon the tube, breaking some of the castings, and damaging the tube. The cylinder had been already tested, having raised the tube 24 feet. It had not been previously tested, on account of the difficulty of providing an apparatus for testing so large a cylinder. It is usual to use such cylinders even with four tons upon the inch; on the present occasion there was only 2 7-10 tons. We were watching the cylinder continually, and it showed no symptons of giving way. The cylinder alone was the cause of the accident; no other part of the machinery gave way. The tube, by the compression of the timber beneath it, descended about 4½ inches. We were wedging the tube up beneath, by driving in planks as it rose, and, on the removal of the planks, underbuilding with brickwork, to avoid any chance of accident. The superficial area of the fracture is about 1,000 square inches, the tension per square inch on this area being at the time about a ton. Four tons per square inch would have been deemed secure. There was at the commencement of the operations a great deal of leakage from this press, but it took place at the top, and was remedied by the addition of a new collar below the original collar. There was no leakage near the fracture. The rope-ladder bears marks of being struck by the descending mass of iron. The deceased had ascended about forty feet."

We may further observe, no damage of any consequence was done to the tube by its fall. The extraordinary test to which it must have been subjected is only another guarantee of the security of the structure, as it has since been determined that it descended seven inches. A new press has been cast, similar to the broken press, with some modification of the bottom, to counteract the effect of contraction in such large masses of metal, which appears to have been the cause of failure. The recurrence of such an event is highly improbable, but precautions have been adopted by Mr. Stephenson to guard against any damage either to the tube or the parties employed in raising it, and even avoid any further delay if such should be the case; and no difficulty whatever can be apprehended in completing the operation. The new cylinder is expected in about a fortnight; and within twelve days after it is fixed the tube will in all probability, be at its proper level. The only important consequence of the accident, as regards the bridge, has been the serious delay in replacing the press.

SYNOPSIS OF THE PRINCIPAL FRENCH, BELGIAN, GERMAN, AND AMERICAN RAILWAYS.

The following are the names and number of miles in length of each railway, viz.:—

French Railways.—St. Germains, 11¾; Versailles (right and left bank), 24¼; Strasburg and Basle, 87; Paris and Orleans, 82; Paris and Rouen, 84; Rouen and Havre, 59; Avignon and Marseilles, 33; Montpellier and Cette, 16¾; Mulhausen and Tham, 11¾; St. Stephens and Lyons, 31; Orleans, Tour, and Bordeaux, 80; Orleans and Vierzon, 144½; Boulogne and Amiens, 95; Paris and Lyons, 320; Great North of France, 337; Lyons and Avignon, 142; Paris and Strasburg, 410.

Belgian Railways.—North line, Brussels to Antwerp, 27¼; West line, Malines to Ostend, 76¼; East line, Malines to the Prussian frontier, 82¾; South line, Brussels to the French frontier, 51; Ghent to the French frontier and Tournay, 48; Tournay and Jurbise and Landen and Hasselt, 48; Braine-le-Compee to Namur, 41; Sambre and Meuse, 60; Louvain a la Sambre, 53; Namur and Liege, 49½; Great Luxemburg, 84.

German Railways.—Leipzig-Dresden, 71½; Leipzig-Magdeburg, 72; Leipzig-Ho, 96; Berlin-Cothen, 96; Berlin-Potsdam, 18; Berlin-Stettin, 89; Berlin-Frankfort-on-Oder, 48; Berlin-Hamburgh, 175; Halle-Eisenach,

120; Hamburgh-Bergerdoff, 10; Altona Kiel, 63; Madgeburg-Halberstadt, 30; Brunswick-Hanover, 40; Hanover-Harburg, 110; Hanover-Bremen, 80; Cologne-Minden, 190; Cologne-Aix-la-Chapelle, 54; Cologne-Bonn, 20; Dusseldorf-Elberfeld, 17; Frankforto M. Wiesbaden, 26; Frankfort-on-the-Maine-Manheim, 48; Frankfort-on-the-Maine-Cassel, 104; Manheim-Carlsruhe-Kehl, 70; Bexbachline, Manheim-Sarbruck, 65; Augsburg-Lindau, 87; Augsburg-Munich, 43; Ansbug-Hof, 220; Nuremburg-Furth, 5; Bamberg-Frankfort-on-the-Maine, 25; Vienna-Gloggnitz, 53; Gloggnitz-Trieste, 350; Nordbalm Vienna-Prague, 500; Prague-Dresden, 115; Dresden-Gorlitz, in progress; Frankfort-on-the-Oder-Breslau, 200; Breslau-Freiburg, 40; Oppelm-Crakau, 90; Budweis-Germurden, 120.

American Railways.—Portland, Saco, and Portsmouth, 50; Concord, 35; Boston and Maine, 46; Boston and Maine Extension, 17; Boston and Lowell, 26; Boston and Providence, 41; Boston and Worcester, 44; Berkshire, 21; Eastern, 54; Fitchburg, 10; Nashna and Lowell, 14; New Bedford and Taunton, 20; Norwich and Worcester, 59; Western, 156; Taunton Branch, 11; Housatonic, 74; Hartford, Newhaven, and Springfield, 63; Stonington, 48; Attica and Buffalo, 31; Auburn and Rochester, 78; Auburn and Syracuse, 26; Buffalo and Niagara, 22; Erie, 446; Harlem, 26; Hudson and Berkshire, 31; Long Island, 96; Mohawk and Hudson, 17; Saratoga and Schenectady, 22; Schenectady and Troy, 20; Syracuse and Utica, 53; Tonnawanda, 43; Troy and Greenbush, 6; Troy and Saratoga, 25; Utica and Schenectady, 75; Camden and Amboy, 61; Elizabeth-town and Somerville, 26; New Jersey, 34; Paterson, 16; Beaver Meadow, 26; Cumberland Valley, 46; Harrisburgh and Lancaster, 36; Hazleton Branch, 10; Little Schuylkill, 29; Blossburg and Corning, 40; Manch Chunk, 9; Minehill and Schuylkill Haven, 18; Norristown, 20; Philadelphia and Trenton, 30; Pottsville and Danville, 29; Reading, 94; Schuylkill Valley, 10; Williamsport and Elmica, 25; Philadelphia and Baltimore, 93; Frenchtown, 16; Baltimore and Ohio, 188; Baltimore and Susquehanna, 58; Baltimore and Washington, 38; Greensville and Roanoke, 17; Petersburgh and Roanoke, 60; Portsmouth and Roanoke, 78; Richmond and Fredericksburg, 61; Richmond and Petersburgh, 22; Winchester and Potomac, 32; Raleigh and Gaston, 84; Wilmington and Raleigh, 161; South Carolina, Columbia, 202; Central, 190; Georgia, 147; Lexington and Ohio, 40; Little Miami, 40; Mad River, 40; Madison and Indianopolis, 56; Champlain and St. Lawrence, 15; State Railways, Columbia, 82; Portage, 130; Central Railways, 110; and Southern Railway, 68.

Railway Fares.—It is pretty extensively understood that a combined move will be made next session by the great railway interests, in part to repair the madness of '45 and '46, by getting powers to charge higher fares. The Government is considered not to be averse, provided reductions are made in the charges for the conveyance of the mails. We may perhaps, have a word or two to say on this subject shortly. As indictments for conspiracies are, however, so much talked of, we hope the railway authorities and Ministers will take care to do nought that will subject them to an indictment for conspiracy against the public.—*Herapath's Journal.*

Berwick Railway Bridge.—Although the railway bridge across the Tweed has now been in course of erection for a period of about two years, yet, from the present state of the works, it is probable that it will not be finished for upwards of twelve months. On the south, or Tweedmouth side of the river, 14 arches have already been completed, and several others on the same side of the river nearly so; but on the north bank, and over the Berwick side of the river, the remaining arches are not nearly so far advanced, and the foundations of one or two of the piers have yet to be laid. When finished, this bridge will be one of the finest of the kind in the United Kingdom, its length being about a quarter of a mile, and its height above the river 120 feet.—*Edinburgh Courant.*

Railroads in Prussia.—A summary of the report presented to the High Court by the Prussian Minister of Finance, shows that 29 railway schemes were sanctioned between 1837 and 1847. Of that number 21 are completed, and four are partly finished. These 29 railroads require a capital of 241,000,000f. The 21 already completed cost 125,000,000f.; the six unfinished ones, 20,000,000f.—total, 145,000,000f. The Government hope to be able to meet the expenses of the railroads with its ordinary resources; if this hope should not be realized, the Government requests permission from the High Court to contract a loan of from 3,000,000 to 4,000,000 dollars.

AMERICAN SCRAPS.

"From the Lehigh Summit Mine, we descended for nine miles on a railway, impelled by our own weight, in a small car at the rate of 20 miles an hour. A man sat in front checking our speed by a drag on the steeper declivities, and oiling the wheels without stopping. The coal is let down by the same railway, sixty mules being employed to draw up the empty cars every day. In the evening the mules themselves are sent down standing four abreast, and feeding out of mangers the whole way. We saw them start in a long train of waggons, and were told, that so completely do they acquire the notion, that it is their business through life to pull weights up hill, and ride down at their ease, that if any of them are afterwards taken away from the mine, and set to other occupations, they willingly drag heavy loads up steep ascents, but obstinately refuse to pull any vehicle down hill, coming to a dead halt at the commencement of the slightest slope."

"A railway train shooting rapidly in the dark through the pine forests of North Carolina has a most singular appearance, resembling a large rocket fired horizontally, with a brilliant stream of revolving sparks extending behind the engine for several hundred yards, each spark being a minute particle of wood, which, after issuing from the chimney of the furnace, remains ignited for several seconds in the air. Now and then these fiery particles, which are invisible by day, instead of lagging in the rear, find entrance by favour of the wind through the open windows of the car; and, while some burn holes in the traveller's cloak, others make their way into his eyes, causing them to smart most painfully."

"One of my travelling companions in Ohio assured me that agricultural labourers from the lowlands of Scotland were the best settlers of all who came direct from Europe. Some of these had arrived with a large family, and with no money even to buy the implements of husbandry, and had in twelve years become the owners of 300 acres of cleared land, in which the log-house was replaced by a neat farm-building called a frame-house, with a small garden attached to it. They laugh here at the common error into which new settlers fall, who possess some money, and have been accustomed to English farming, especially their diligence in uprooting stumps, which have so slovenly an appearance. This practice seems to be, in their eyes, the most unequivocal test of extreme ignorance of the relative value of labour and land in a new country. Foreigners who have a small capital should always settle in districts which have been already cleared and broken up by the plough."—*Lyell's Travels in North America.*

NOVELTIES.

Welbeck.—The Duke of Portland has long contemplated a great work which is now in the course of being vigorously prosecuted. This is the erection of a bridge over the Welbeck lake head, near what is called Moss-hall and the Dogkennels. Masons are daily expected from London, and a good deal of stone has been already got and hewn ready in blocks of various dimensions. The high hill, at Whitwell, has supplied some much more preferable to the Anston stone, it is said, which has been so much called for for the new Parliament Houses.—*Derby Courier.*

Drainage of Towns.—The expense of putting Worcester into good sanitary condition has been estimated by Mr. Austin at £47,000, including £23,000 for machinery and works for collecting and distributing the city sewage for agricultural purposes, and also £10,000 for the erection of baths and washhouses.——A survey of sewers and drains at Sheffield is in progress, with the view of ascertaining the best mode of securing an uninterrupted efflux of their contents into a capacious general outlet proposed to be opened to the Don at Attercliffe.——The complete sewerage of Winchester, according to a semi-official announcement, will cost £4,500.——A company has been established in Leeds for the purpose of converting the contents of the sewers, cesspools, &c., into manure.

Window Sashes for Lunatic Asylums.—Mr. Thomas Melling, of the Rainhill Iron Works, near Liverpool, has taken out a patent for a new arrangement of apparatus for window sashes, in lieu of sash weights and pulleys, by which space is open for ventilation, while the possibility of escape through such opening, or persons entering from without, is precluded. A rack is fastened on the inside of each outer rail of the upper sash, and also on the outside of the lower one. A shaft crosses the centre of the window frame between the two sashes, at each end of which is fixed a pinion, which takes into the two pairs of racks, by which arrangement, on raising the lower sash by the action of the racks and pinions, the upper one is lowered to the same extent, and, according to the length of the rack, the spaces for the admission of air may be regulated to any width required.

A Wire Suspension Bridge has been thrown across the Ohio. It is 1,010 feet in length.

Mosaic Glass.—We have lately been favoured with a sight of a work of art quite novel.—It is called mosaic glass, and is adapted to many different purposes—church windows and church decorations, shop windows, and fanlights, window blinds, staircase windows, &c. It it equal in beauty and transparency to the most brilliant stained glass, and the designs for window blinds and other purposes are very rich. It has been brought out and patented at considerable expense and with much labour; but we have no doubt the company will be amply rewarded, for it requires only to be seen to be appreciated. It is produced at one-sixth the cost of stained glass; but it is not unlikely that its price will be enhanced when it has become well known, as the demand will be great. For church windows it is admirable, from the variety and beauty of the designs; and of its durability, the mode of combining the colour with the glass is a sufficient guarantee. It is also brought out in labels to a large extent, and indeed, the variety of purposes to which it is applicable is very great.—*Leeds Intelligencer.*

The Iron Roof, Lime-street Station, Liverpool.—At a meeting of the Liverpool Polytechnic Society, held last week, Mr. Turner, of Dublin, who is constructing the new galvanised iron roofing and other iron wooks of the Lime-street Railway Station, furnished the meeting with the following particulars:—The roof covers an area of 6,140 square yards, being about 360 feet in length, and 153 feet 6 inches in width. There are no intermediate columns; but this great space is spanned over by one stupendous arch, rising in a segment of a circle, to a central height of 30 feet from the spring or chord. The roof consists of 17 curved girders of wrought iron, resting at one side upon the walls of the offices, and at the other upon cast iron columns of the Doric order, connected by ornamental arches, in perforated iron. These girders are trussed vertically by a series of radiating struts, acted upon by the bars connected with the extremities of the girders; and they are trussed horizontally by a series of purlins and diagonal rods, thus forming one rigid piece of framing from end to end. Upon this framing will be laid plates of galvanised corrugated iron, and three ranges of plate-glass (in sheets about 12 feet 6 inches in length, and of great thickness), extending the whole length of the roof. In consequence of the great extent of surface exposed to the variations of temperature, provision has been made for expansion and contraction of the iron without injury to its bearings. The roof, when finished, will weigh about 700 tons. The whole of the work, with the exception of the cast iron columns and ornamental arches, is of wrought iron. The iron columns upon which the roof rests on the south side of the yard are two feet three inches in diameter at their bases. Six of the girders are fixed, and the centres struck.

Imports and Exports of Iron in 1848.—From a Parliamentary return, it appears that the quantity of foreign iron, chiefly Swedish and Russian, imported in 1848, was 23,869 tons bar-iron, 464 tons blooms, 257 tons old iron, and £28,891 odds in value of wrought-iron and steel. The quantity of foreign bar-iron exported was 3,432 tons, of steel unwrought 340 tons, of wrought-iron and steel, value £11,560. The value of foreign iron retained for home consumption was £17,331. Of British iron exported, chiefly to the United States, Holland, Iceland, Denmark, &c, there were 175,650 tons pig, 32,135 tons bar, 17,554 tons bolt and rod, 19,371 tons cast, 76,365 tons wrought, and 61,913 tons steel unwrought, besides 1,913 tons wire and 7,241 tons old iron. The exports of British hardware and cutlery amounted to 18,105 tons, value £1,860,150, chiefly to America and Canada, East Indies, &c. Of British machinery and mill-work, the value of exports was £817,656, chiefly to Russia, Spain, Italy, Hans Town, France, Brazil, &c.

Hastie's Semi-Gravitating Steam Engine.—We learn from the *Greenock Advertiser* that Mr. Hastie, (of Messrs. Scott and Sinclars' Works) has invented and patented an engine, in which the cylinder cover is dispensed with, and the connecting-rod attached directly to the piston, which is made of a depth equal to the diameter of the cylinder. The steam, of course only acts one way, and the fly-wheel is loaded so as to equalize the power. Thus a cylinder of double the usual area is required for a given power, and the cold atmospheric air is admitted at every stroke. Such an idea might be tolerated in a model, but to patent such a thing indicates a large share of self-conceit.

Dover's Deoderizing Agent.—Some experiments have been exhibited by Mr. Dover for the purpose of showing the efficacy of a disinfecting and deodorizing agent which he has discovered but with the nature of which we are not yet acquainted. It is proposed to run the sewage water into tanks, in which the disinfecting liquid will be mixed with it, and after all the solid matter is deposited the liquor is filtered by ascension through a layer of charcoal, and may then be allowed to escape. The deposit in the tanks is dried and then has the appearance of, and may be applied to the same purposes as guana. We fear that these processes will not bear competition with the more direct process of applying the sewage water to the crops, for we believe that a great part of the efficacy of the liquid manure depends upon its liquidity; the water supplying the plant with the necessary irrigation, while the food is applied in a finely divided slate and is thereby more readily absorbed.

The Fire Annihilator.—Some experiments have been tried at the Gas Work, Vauxhall, by Mr. Phillips on his Patent Fire Annihilator. This invention consists in evolving carbonic acid gas in the room or house on fire, and is said to be exceedingly efficacious. For buildings in the country where a supply of water and engines are not readily obtainable we think it may be useful, but it appears to us that it would be found wanting in cooling adjacent buildings and so preventing the spread of fire, which is really the strong point of our present fire engines, for as we have already remarked they are quite ineffectual in saving the building in which the fire began. Mr. Phillips will perhaps recommend us to use both.

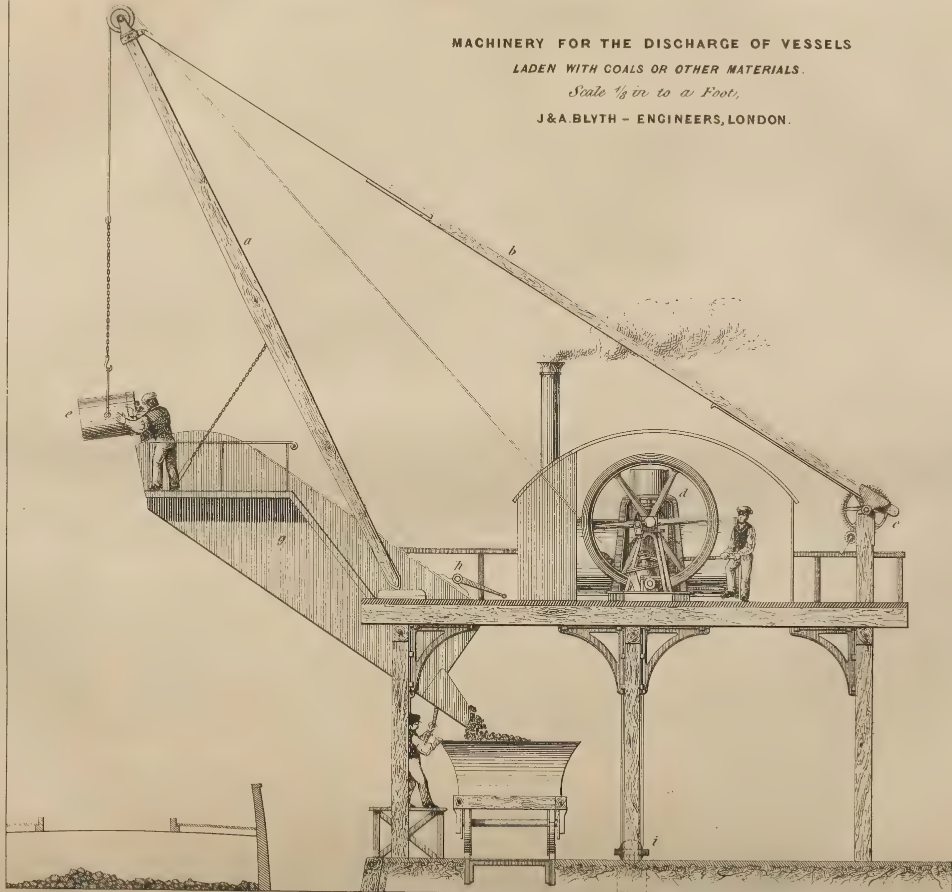
Post Office Improvements.—The recommendation of the post-master general in favour of letter boxes seems to be taking effect if we may judge from the number of boxes exhibited in the ironmongers' windows. Amongst others there is one registered by Messrs. Deane, in which the letter in its entrance sounds a little bell and announces the delivery. This will do well for offices, but in those we have seen would hardly be loud enough for large houses if placed on the front door. In the latter however, it might be easily arranged that the letter in its fall should release a trigger and ring the large door bell. The saving of time and trouble to to the postmen would be very great if the letter box system were fully carried out. Supposing the postman to have so call at only sixty houses and be delayed half a minute at each, a very moderate estimate, the last letters are delivered half an hour later than there is any occasion for. This is leaving the mens' comfort out the question, and we believe there is no doubt about their wages being the *minimum* and their work the *maximum.*

North Surrey Industrial Schools.—In consequence of the calamitous occurrence at the late Mr. Drouet's school at Tooting, the guardians of the poor-law unions, forming the North Surrey district, resolved to form a school district, and to erect suitable buildings. For this purpose, fifty acres of land have been purchased, adjoining the Anerley station of the Croydon Railway, at Penge, Surrey, and tenders have been advertized for, to carry out designs prepared for the building by Mr. Charles Lee. The establishment is to be industrial, to have accommodation for 250 boys, 210 girls, and 140 infants, with three school-rooms and class-rooms, with apartments for steward, matron, three school-masters, and three school-mistresses, with dining-room, chapel, chaplain's-room, board-room, kitehens, bakery, offices, lavatories, baths, and workshops; also separate laundry-building, with all the necessary rooms attached thereto for drying, ironing, &c.; likewise a detached infirmary building, having all the requisite wards, nurses' rooms, kitchen, washhouse, surgery, &c.; there are to be also farm-buildings, so that the boys may be instructed, not only in trades, but in farming operations, and the girls in dairy-work as well as in cooking household-work, and needle-work.

Baths and Washhouses.—At a meeting of the Works Committee of the Goulston-square model establishment, on 6th instant, returns were read, from which it appears that from 26th July, 1847, to 31st December, 1848, the number of bathers was 81,694, and the receipts £914 19s. 1d.; and that thence to 1st instant the number of bathers was 82,219, and the receipts £1,058 1s. 7d. During the latter period the number of baths to men was 77,831—to women, 3,187—to children (sometimes four together), 1,201; and the weekly average was—to men, 2,223; women, 91; children, 35; weekly receipts, £30 5s. 4d. That even these encouraging returns were limited by the accommodation, appears from another return, showing that, since all the baths have been brought into use, there was an increase of 36,679 bathers during the three last months over those during the same months of last year. In the washing department, since 30th of April last, the number of washers, to 1st instant, was 3,013, and the number of driers the same; the number of hours' washing and drying being 10,005—average 3 hrs. 20 min. to each washer and drier. No ironing appears to have been done.

Baths and Washhouses, Liverpool.—A third suite of baths and washhouses have been ordered to be erected by the Health Committee, from plans proposed by the borough engineer. The site selected is at the junction of Cornwallis-street and Leveson-street, which forms the east corner of the spacious square enclosing St. Michael's church and cemetery. The building, we are told, is designed in the simplest Italian style, two stories in height, and with projecting roof, and includes first, second, and third-class baths, and two classes of washing stalls, each of which will be distinct and separate from the rest, "with improved and original contrivances for wringing and drying the clothes."

Manchester Borough Gaol.—The new prison at Manchester, alluded to by us some time since, is now nearly completed. It is stated that the cost of it will be about £120,000, and it is calculatated to accommodate 500 prisoners. The cost, per individual, will therefore be £240. About two years have been occupied in raising it. The boundary wall of the gaol incloses almost ten acres of ground, of which 5,641 square yards are occupied by the prison building, the remainder being exercising grounds, yards, &c.



MACHINERY FOR THE DISCHARGE OF VESSELS

LADEN WITH COALS OR OTHER MATERIALS.

Scale ⅛ in to a Foot,

J & A. BLYTH – ENGINEERS, LONDON.

Lith. Waterlow & Sons, London

THE ARTIZAN.

No. XI.—Fourth Series—NOVEMBER 1st 1849.

MECHANICAL ENGINEERING.

STEAM COALING MACHINERY AT LOWESTOFT HARBOUR.

The economical application of power for the purpose of raising heavy weights into stores, warehouses, &c., has been the subject of various experiments, exhibiting more or less ingenuity, but which do not seem to have combined the requisites of economy in first cost, and economy and facility in working, in a sufficient degree, to procure their general use.

Tread-wheels are still used in some of the docks on the River Thames, but their use has been discontinued in many other places, on account of the danger to the men working them. These tread-wheels, it may be as well to explain, are internal tread-mills, in which the men run round like so many squirrels in a cage, and are constantly exposed to the danger of being dashed to pieces, should their weight from any accident be insufficient to overcome the load. In order to lower with these wheels, the winding-drum is thrown out of gear, and the weight lowered by means of a break. Another plan, still much used for clearing the holds of ships of chests of tea, bags of sugar, and similar articles, consists of a frame of considerable height fixed on the deck, and provided with ladders, with a sliding frame connected with it, on which the men descend and raise the load over a pulley, by their own weight. These plans are supposed to possess this advantage, that each man is compelled to do a certain share of the work; that is, he must lift his own weight, and it is thought more advantageous to take the chance of occasionally getting light men than of having skulkers.

The landing of coal, from its bulk, and the enormous quantity used, offers a favourable opportunity for applying steam power; and, accordingly, we find that various methods have been introduced to supersede the system of coal-whipping, which becomes a serious expense, when the height to which the coal has to be raised is more than a few feet. We shall take an early opportunity of reviewing these several plans, but for the present shall confine ourselves to the consideration of that shown in our plate, which was designed and constructed for Lowestoft Harbour, by Messrs. J. and A. Blyth, engineers, of London.

A number of these hoisting-machines are arranged upon a wharf, alongside which the colliers lie while being discharged, and the coals, after being lifted out of the hold, are shot into waggons which stand on a siding of the Norwich and Lowestoft Railway.

In these machines a double derrick *a*, is mounted upon a stage of sufficient height to allow a locomotive and train of waggons to pass underneath. The overhang of the derrick is regulated by a back stay *b*, to suit the position of the hatchway of the collier alongside the wharf. The backstay is provided with a a rack and gearing at *c*, by which any requisite alterations in the angle of the derrick is easily effected. A small oscillating steam engine of four horses power is fixed as at *d*, the power of which is communicated to the winding-drum by means of bevil reversing-gear. The winding-rope, which terminates in a hook at *e*, takes several turns round the barrel, and is then extended downwards, and attached to a balance weight at *i*. This balance weight is made equal to the weight of the bucket attached to the hook at *e*, together with half the weight of one bucket full of coals. By this means the resistance to the engine is equalised both during the ascent of the loaded bucket, and its descent when empty; and the advantages of such a plan are, that the motion of the engine being preserved continuously in one direction with its velocity unabated, an engine of less power is required than if the full weight of both coals and bucket had to be raised during the ascent, and the empty bucket were allowed to descend by its own weight. In this particular case, the balance weight is arranged so as to ascend and descend only half the distance of the bucket, by means of the pulley: this is done to save height, and the balance weight consequently requires to be made twice as heavy.

The reversing of the winding barrel is effected by means of a lever, by which the engine-driver throws one or other of the friction clutches into gear; and the same lever, by its action on the throttle-valve, admits the full pressure of the steam upon the engine the instant that either clutch is in gear. This throttle-valve is so arranged that, when the lever is horizontal and neither clutch engaged, the steam admitted is only sufficient to preserve the motion of the engine in its then unloaded state. Three or more buckets are used at one time, in order that the filling in the hold may keep pace with the raising and emptying of a full bucket. On the arrival of the empty bucket in the hold, it is unhooked, and a full one hooked on; and during the hooking and unhooking and emptying of the buckets, the weights of the full bucket and of the balancing weight are respectively held stationary by a friction strap, acted upon by the foot of the engine-driver.

The bucket, when raised, is discharged into the shoot *g*, which is provided with a sliding door at its lower extremity, and this is closed at the pleasure of the attendant by means of the lever *h*. Thus each waggon is filled successively, and the weight ascertained by a weighing machine, on which it stands during the filling.

These machines work very satisfactorily, and when worked by men at piece work, twenty tons of coal are raised per hour with great ease.

Somewhat similar machinery, and made by the same Firm, is in use at the Thames Plate Glass Works, at Blackwall; but the object there being to *house* the coals, the bucket is capsized at once into a waggon, placed on a line of rails on the upper platform, and extended on a level into the roof of the coal store. The waggons are pushed by hand along this railway, and having drop bottoms, are discharged throughout the store at pleasure.

Some idea may be formed of the saving resulting to this company from the use of such machinery, when the fact is known that their consumption of fuel is upwards of 1,000 tons a month.

A floating coal depôt in Portsmouth Harbour, capable of holding 2,000 tons of coals, is also being fitted with similar machinery, by which it is intended to coal the Government steamers. To the working of this we look forward with much interest, and full illustrations of it will be given in a subsequent Number.

AITKEN'S PATENT VACUUM VALVE AND ATMOSPHERIC CYLINDER.

At the time of giving engravings of these improvements (pp. 170—195), we promised to report the particulars of their application, which we are now enabled to do.

The vacuum valve has been applied to engines of the total amount of 2,000 horses power. The vacuum is improved by its application from ½ to 1½ inches by mercury guage. In a mill at Staleybridge, the vacuum was improved from 29½ to 30 inches. The valve may be said to act in two ways—first, by drawing off the vapour from the condenser, and secondly, by allowing more injection water to be used with safety. This is well defined in the following report, which we have selected from several others submitted by the patentee.

"We have this day tested Aitken's vacuum tube as applied to one of the engines of the *James Atherton*, New Brighton ferry boat. The diameter of the cylinder is 28½ inches, stroke, 3 feet. Number of revolutions, about 30 per minute. Steam in the boiler, about 12lbs. Side lever engine, about 6 years old. Before the application of the vacuum tube, the barometer on the condenser used generally to range from 27½ to 28. To-day it improved to 28¾. We consider that the increased quantity of water used in consequence of the thump of the valves being removed, caused the improvement to 28 inches, and that the further improvement from 28 to 28¾ is due to the passage of vapour from the condenser to the air-pump through the vacuum tube. This result we consider satisfactory, inasmuch as the tube is not advantageously applied from want of room, the diameter being only 2½ inches, and the length, 4 feet.

"Douglas Hebson, Consulting Engineer.

Liverpool. "Anthony Bower, of Vauxhall Foundry."

Messrs. Bury, Curtis, and Kennedy, of the Clarence Foundry, Liverpool, report an improvement of 1½ inch on board the Chester and Holyhead Company's steamer, *Hibernia*. The valve is also in use on board two of the Folkestone boats, and in the *Flora*, on the Thames. This invention seems to us especially valuable in vessels, where the steam pressure has, by the introduction of tubular boilers, been increased, and where, from the desire of improving the speed of the boat, but little expansion is used. In many such vessels, 26 inches is the best vacuum obtained, and in those cases, a material benefit may be derived from the application of this simple and inexpensive addition to the engines.

With respect to the atmospheric cylinder, we learn from indicator diagrams taken by Mr. Hick, of Bolton, that the saving of power on a thirty horse engine, was 1.25 horse, in addition to an improvement in the vacuum, although the invention was applied under unfavourable circumstances, owing to the injection water having to be lifted some height by the auxiliary or atmospheric cylinder. Messrs. Forrester report an improvement of 1lb. in the vacuum, and that the whole of the load of the air pump is taken off the engine.

There is a fact connected with the passage of the water through the cylinder, and the improvement in the vacuum, which is worth noticing. It is this, that the air is extracted from the injection water, and leaks past the piston of the auxiliary cylinder, into the vacuum above it, and is discharged by the escape valve on the up stroke. There is no doubt that if, by any means, we can deprive the injection water of the air it contains, the vacuum will be materially improved, and this appears to be effected to a certain extent by this arrangement. There is, however, another important benefit to be derived from the application of the atmospheric cylinder. It will be remembered, that great stress was laid by the advocates of Hall's system of surface condensation, on the fact, that all anxiety as to the choking of the engine, was removed by that system, from the mind of the engineer. Now this plan possesses the same advantage, and on that account alone, we consider it worthy of attention. Messrs. Main and Brown in their valuable work on the Marine Engine, mention a special case in point.

SIMS' PATENT DOUBLE CYLINDER COMBINED PUMPING ENGINE.*

The patent double cylinder engine, of which we have given a plate, is one designed by, and constructed under the superintendence of, Mr. Hodge, C.E., for the Guadal Canal Mines, in Spain. It is on Mr. Sims' principle, arranged so as to render it suitable to the peculiar circumstances of the case. We shall first consider the principle on which this engine is constructed, and then offer a few remarks on Mr. Hodge's work, from which our plate is obtained.

Previous to the introduction of Boulton and Watt's engine into Cornwall, Jonathan Hornblower had been one of the principal engine-makers for that district; and in 1781 he took out a patent for a double cylinder engine, which is said to have been invented in 1776. This engine was similar to those now made by various engineers, with the two cylinders side by side; but, although the same principle was adopted by Mr. Woolf, we are not aware that the double cylinder principle was much used in Cornwall until Mr. Sims, of Redruth, introduced his patent double cylinder engines, as exemplified in our plate, of which there are now upwards of sixty at work, as stated in a letter by Mr. Sims, in the *Artizan*, page 174 of our last volume.

The advantages which the double cylinder engine possesses over the single cylinder are, that the parts may be made lighter, that the motion is more uniform, and that a shorter stroke suffices for the same rate of expansion. Its disadvantages are—increased cost, and more friction. This subject has been often discussed in the *Artizan:* we need not, therefore, do more than repeat the axiom, that no economy of steam can be effected by a double cylinder engine of any description that cannot also be effected in a single cylinder engine, the cylinder of which is equal in contents to the sum of the contents of the two cylinders of the other engine. Mr. Hodge's remarks seem to us to bear an interpretation contrary to this fact, which we should be glad to see cleared up by the author.

In Mr. Sims' engine only one cylinder full of steam is consumed for a double stroke, or one revolution of the crank, thus:—A constant vacuum is maintained between the two pistons, by a communication with the condenser, and the down stroke is performed by the admission of steam from the boiler on top of the small piston, which descends with the full pressure of the steam, there being a vacuum both above and below the large piston. When the down stroke is completed, the steam is allowed to flow from the top of the small piston to the underside of the large one, to effect the up stroke by its expansion, the amount of which will be in proportion to the respective contents of the two cylinders. But the whole of the area of the large piston is not effective surface, because there is the same pressure per square inch on the top of the small piston as on the under side of the large one; consequently, the effective area is the *difference* between them, or, in other words, the annular space. When the up stroke is completed, the steam is allowed to pass to the condenser as usual.

There is a peculiarity in this engine, which, although not of so much importance in a pumping engine, is a serious objection against its use as a crank engine, viz., that each cylinder being used for half a revolution only, an engine of double the size is requisite to exert a given power, as compared with the ordinary engines, and the increased cost will, we imagine, materially operate against its use in that form. In this particular engine the piston is carried through the bottom of the cylinder, and connected to the beam, which is placed below, instead of above, the cylinder, as in ordinary engines. By this arrangement the weight of the beam is brought down close to the foundation, and the expense of building the cylinder wall is obviated.

The speciality of Mr. Hodge's work is much in its favour, both on account of the facility of reference, and the economy in adding the volume to a library of other works on the steam engine, none of which have yet been published, with so full and elaborate an analysis of the mechanical effect to be derived from expansion, and the formulæ applicable in the various cases.

The following paragraphs embrace the points on which we are at issue with the author, and which appear to us to require some qualification which we have not yet met with:—

"In Woolf's engine, as we have already seen, the steam is acting on both pistons at the same time; that is, on the lesser at full pressure as it is received from the boiler, and on the larger by expansion, consequently there are two cylinders full of steam constantly in operation after the engine has

* "Analytical Principles and Practical Application of the Expansive Steam Engine." By P. R. Hodge, C.E. Quarto, pp. 172—plates, 8. London: J. Williams and Co.

been started, and this requires the lesser cylinder to be twice filled with steam at full pressure, to work the ascending and descending stroke, or to carry the pistons from the bottom to the top, and from the top to the bottom, of their respective cylinders; *so that, in respect to the economy of steam, this kind of engine possesses no advantage whatever over the double-acting non-expansive engine commonly in use.*"

"In Mr. Sims' arrangement, on the other hand, the steam is acting only on one piston at a time—that is, in the upper cylinder it acts at full pressure against a vacuum; consequently, one cylinder full of steam from the boiler completes the stroke, both descending and ascending, *so that an engine of this construction consumes only one-half the quantity of steam that is consumed by Woolf's, while at the same time it developes a greater and more uniform power, all other conditions and circumstances being equal.*"

PROGRESS OF COTTON MANUFACTURE IN THE SOUTHERN STATES OF AMERICA.

The statistical notices regarding the disposal of the cotton crop have shown a domestic consumption, during the last year, of 518,039 bales. This, however, does not include the amount manufactured in the neighbourhood of the plantations in the south. This, it is estimated, must exceed 100,000 bales. The total consumption is reckoned at 623,038 bales against 276,018 ten years ago. This increase is accounted for by the outlay of capital in mills, &c., which, in Georgia, is put down at a late meeting of the mill proprietors, at about 3,000,000 dollars. The expenses saved by manufacturing on the spot, include the cost of delivering the cotton at the shipping port, including the rope and wrapper required for packing, freight to the northern port, and thence to the manufacturing town, and freight of the cloth back again for consumption at the south, to all which must be added commissions, insurances, storages, &c.

The aggregate expense would thus evidently amount to a very heavy per centage on an article of such small value compared with its great bulk, particularly when prices rule low, and would offer every inducement to the inhabitants to manufacture as well as plant, confining that branch of industry, as a matter of necessity to the coarser fabrics of cotton and wool of the descriptions required for local consumption, while the same charges would amount to so small a per centage on finer fabrics, as to render it not worth their while to attempt them. An abundance of water power is to be found in all directions, and the cost of labour and capital becomes matter of easy calculation.

A New Orleans writer gives the following estimate of the expense and profit of a cotton and woollen factory, which he states to have been made up by a well-known practical man, and may be relied on.

He commences with a capital of 30,000 dollars, which is, of course, invested in buildings and machinery, and his expenditure is—

	d.	c.
9 men at 75 cents per day	6	75
20 boys at 40c.	8	0
26 girls at 50c.	13	0
1 spinner	2	0
1 weaver	2	0
1 superintendent	3	75
1 fireman	1	0
1 watchman	0	75
4 cords of wood at 1d. 75c.	7	0
1½ gallons of oil at 1d. 25c.	1	87
Incidental expenses	1	0
2 men for other work	3	0
1,155lb. cotton at 6c.	69	30
300lbs. wool at 18c.	54	0
Loss in waste	8	0
Interest on capital, 8 per cent.	6	67
Insurance on do. at 2 per cent.	1	67
Board of 45 negroes at 20c.	9	0
Do. 7 whites at 30c.	2	10
	200	86

The foregoing comprises the whole daily expenditure, from which he derives a product of—

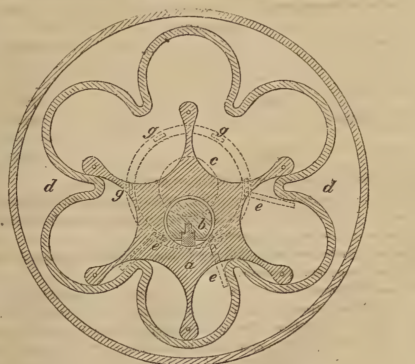
2,161 yards of 4-4 Osnaburghs, at 9c.	194	40
300 yards of 4-4 Kerseys, at 25c.	75	0
	269	40
Leaving a nett daily gain of	68	51

or, per annum, for 313 working days, 21,443d. 2c., which is equal to 70 per cent. profit on the invested capital; to which may be added, the additional local advantage of the expenditure of the operatives. The prices assumed for raw materials and cloth, were the regular average value of those articles previous to their present rise.

THE ORKNEY ROTARY ENGINE.

We had the pleasure, a short time since, of inspecting, at Taplow, the working of Captain Fitzmaurice's rotary engine, which has been applied to propel a screw boat belonging to Government. The engine is worked high pressure, and non-condensing, with a locomotive boiler, and at 480 revolutions per minute, is estimated at 16-horse power, though we should feel no positive confidence in anything short of the application of a friction brake, for arriving at the actual power exerted by the engine.

The boat is a very heavy one, and not at all adapted for speed: nevertheless, she is propelled at from seven to eight miles per hour. The accompanying sketch will give an idea of the construction of the engine. There



are six cells in the outer shell, *d d*, which are bored out, and the junctions slotted to the same curves as the piston, *a*. This piston is free to turn on the crank-pin, *b*, which reaches across the shell, and is in a piece with the crank shaft, *c*, which protrudes through a stuffing-box in the shell. Thus, supposing the crank to revolve, the piston moves with it, each of its six arms describing a circle within its cell. The piston is represented with its lower arm at half stroke, and moving to the left, the steam being admitted through the three slots, *e e e*, and being exhausted through *g g g*. Although it is not absolutely necessary, the outer shell is allowed to revolve with the inner piston, in order to do away with the vibration, which is found to be very great when the shell is held stationary, but which is not felt in the least degree when it is left free to revolve. What will probably startle our readers more than anything else is, that the system of metallic packing, which has been so much relied on in other rotary engines, is here thrown overboard altogether, and dependence is placed merely on the contact of the rolling surfaces. Our experience of the engine is too slight to warrant our giving any opinion at present on its peculiarities, but we hope by next month to be able to throw a little more light on this novel invention.

DIMENSIONS AND DETAILS OF NEW STEAMERS.

THE PACIFIC STEAM NAVIGATION COMPANY'S IRON VESSELS "BOLIVIA," "EQUADOR," AND "NEW GRENADA."

"THE BOLIVIA."

Built and fitted by Mr. R. Napier, Govan and Glasgow.

Builder's Measurement.

	Feet	Inches.
Length aloft	200	0
Keel and forerake	200	0
Breadth of beam	27	0
Depth of hold	15	3
Length of engine space	62	8

TONNAGE.

Hull	$704\frac{59}{94}$
Engine space	$231\frac{53}{94}$
Register ... ... Tons ...	$473\frac{6}{94}$

NEW MEASUREMENT.

	Feet.
Length on deck	197.5
Breadth on do. amidships	26.0
Depth of hold, do.	15.0
Length of poop	56.5
Breadth of do.	29.4
Height of do.	6.9
Length of engine space	62.7

TONNAGE.

Hull	$649\frac{72}{100}$
Poop	$124\frac{4}{100}$
Total	$773\frac{76}{100}$
Engine space	$264\frac{64}{100}$
Register	$509\frac{12}{100}$

A pair of side lever engines of 262 horse nominal power.

Cylinders, 60 inches diameter × 5 feet stroke; paddle wheels, diameter, extreme, 23 feet; ditto, effective, 22 feet, 4 inches; floats, 8 feet $1\frac{1}{2} \times 2$ feet, 3 inches; three sets of 20 arms and floats.

Three tubular boilers with 486 brass tubes, $2\frac{3}{4}$ inches internal diameter × 7 feet long; nine furnaces.

Fourteen strakes of plates from keel to gunwale, tapering in thickness from $\frac{3}{4}$ to $\frac{7}{16}$ inch; frames, $5 \times 3 \times \frac{1}{2}$ inches, and 18 to 24 inches apart.

The use of iron in place of wood is carried further in this vessel than in any other hitherto built on the Clyde, she being all iron from the keel to the poop, including the paddle-boxes and boltsprit, the latter painted to resemble wood.

The *Bolivia* was launched at 2 p.m. on August 4, 1849.

Launching draught, 4 feet 2 inches forward, and 4 feet 10 inches, aft.

She has two masts, brig-rigged; standing boltsprit; quadruped figure-head ("Lama,") clipper-bow; no galleries, and is a round-sterned and clinker-built vessel of iron; hurricane-decks, each 7 feet 6 inches above main deck, fitted with every accommodation necessary for a hot climate; two ordinary and two life-boats.

The *Bolivia* is advertised to sail from Liverpool, and will run in consort with the *Peru, Chili, Equador and New Grenada.*

THE "EQUADOR," AND "NEW GRENADA."

Builder's Measurement.	"Equador." Ft.	In.	"New Grenada." Ft.	In.
Length of keel and fore-rake ...	168	0	178	0
Breadth of beam	23	0	25	0
Depth of hold	14	0	14	10
Length of engine space ..	43	5	56	7

TONNAGE.

Hull	$449\frac{34}{94}$	$547\frac{27}{94}$
Engine space	$134\frac{56}{94}$	$155\frac{78}{94}$
Register ...	$314\frac{72}{94}$	$391\frac{43}{94}$

NEW MEASUREMENT.

	Ft.	Ft.
Length on deck	167.3	177.4
Breadth on do. amidships ...	22.6	24.6
Depth of hold do. ...	13.9	14.6
Length of poop	... ...	54.7
Breadth of do.	... ...	25.8
Depth of do.	... ...	7.1
Length of engine space ...	43.4	56.6

TONNAGE.

Hull	$394\frac{71}{100}$	$540\frac{74}{100}$
Poop	... ...	$108\frac{44}{100}$
		$649\frac{18}{100}$
Engine space	$147\frac{61}{100}$	220
Register ...	$247\frac{10}{100}$	$429\frac{18}{100}$

	Ft.	In.	Ft.	In.
Nominal horse power ...	174	0	212	0
Diameter of cylinders ...		50		54
Length of stroke	4	6	5	0
Diameter of air-pumps ...		44		30
Length of stroke	2	6	2	6
Dia. of paddle wheels, extreme	22	0	23	0
Do. do. effective	21	6	22	2
Length of floats	7	6	7	0
Breadth of do.	1	8	2	0
No. of arms	11		22	
Do. floats	22		22	
Sets of arms	3		3	

The *Equador* was built and fitted with a pair of double side-rod, direct acting engines, by Messrs. Tod and McGregor, Glasgow, in 1845.

The *New Grenada* was built and fitted by Messrs. Smith and Rodger, Glasgow, in 1846.

THE "PREMIER," AND THE "LOCH LOMOND."

Built by Messrs. Denny, Dumbarton, and fitted with engines by Messrs. Smith and Rodger, Glasgow.

Builder's Measurement.	"Premier." Ft.	In.	"Loch Lomond." Ft.	In.
Length of keel and fore rake ...	137	6	126	0
Do. of engine space	32	4	32	6
Breadth of beam	17	7	16	9
Depth of hold	7	0	6	11

TONNAGE.

Hull	$212\frac{39}{94}$	$174\frac{66}{94}$
Engine space	$52\frac{79}{94}$	$49\frac{23}{93}$
Register ...	$159\frac{54}{94}$	$125\frac{43}{94}$

NEW MEASUREMENT.

	Ft.	Ft.
Length on deck	137.5	126.
Breadth on do. amidships	17.15	16.3
Depth of hold do.	6.9	6.7
Length of engine space	32.4	32.5

TONNAGE.

Hull	127	$106\frac{11}{100}$
Engine space	$41\frac{49}{100}$	$38\frac{11}{100}$
Register	$85\frac{51}{100}$	$67\frac{70}{100}$

A single steeple engine in each boat on Mr. D. Napier's patent 4-piston-rod principle, with vertical tubular boiler.

	h.p. 62		h.p. 56	
Nominal power	Ft.	In.	Ft.	In.
Diameter of cylinder		44		42
Length of stroke	3	6	3	6
Diameter of air-pump		24		24
Length of stroke	1	9	1	9
Diameter of paddle wheels, extreme ...	16	2	15	5
Do. do. effective ...	15	8	14	11
Length of floats	6	0	6	6
Breadth of do.	1	1	1	$0\frac{1}{2}$

Two sets of 8 arms and 16 floats in each wheel.

The *Premier* is the property of the New Dumbarton Steam Boat Company, plying between Glasgow, Dumbarton and Greenock. The former vessels of this company were the *Hero* and *Maid of Leven*, 1839, Dumbarton Castle, 1840.

The *Premier* was built in 1846; engine makes 38 revolutions per minute; steam pressure 15 lbs.

She has one flush-deck; one mast sloop-rigged, no figure-head, galleries nor boltsprit, and is a square-sterned and clinker-built vessel of iron, Commander Mr. John Wilson, Port Glasgow.

The *Loch Lomond* has three paddle boards in the water at a draught of 3 feet on an even keel, and the engine makes on an average, 38 revolutions per minute, with steam pressure of 15 lbs.; speed 15 miles per hour; consumption of fuel, 4 tons 16 cwt. of coals per day of 10 hours, running 90 miles per day.

Frames $2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$ inch, and 2 feet 6 inches apart; six strakes of plates from keel to gunwale.

The *Loch Lomond* was the first iron steamer built in Dumbarton, and draws less water than any other steamer on the Clyde. She is the property of the Old Dumbarton Steam Boat Company, which is the oldest river steam boat company in Europe. Their first steamer, the *Wellington*, was built by Mr. Archibald McLauchlan, of Dumbarton, in 1815; length, 60 feet; beam, 15 feet, and 61 $\frac{82}{94}$ tons of hull, and 3 feet draught, with an engine of 16 horse power, by Messrs. Duncan, McArthur and Co., Glasgow. Their later steamers were the *Dumbarton*, in 1820; the *Leven*, in 1824; the *New Dumbarton*, in 1828; the *Vale of Leven*, in 1835; *Loch Lomond*, in 1838; *Prince Albert*, in 1840.

The *Loch Lomond* has one deck; one mast, sloop-rigged; no boltsprit, galleries, nor figure-head, and is a square-sterned and clinker-built vessel of iron; commander, Mr. James Lang, Port Glasgow. F. B.

THE STEAMBOAT "JOSEPH BELKNAP,"

RECENTLY BUILT IN NEW YORK, AND RUNNING ON THE HUDSON RIVER FROM NEW YORK TO WEST POINT.

Length on deck, 187 feet; breadth outside of plank, 27 feet 4 inches; depth of hold, 8 feet; draft of water, 4 feet; plank of yellow pine, $2\frac{1}{2}$ in. thick; floor timbers 13 in. deep, $4\frac{1}{2}$ in. thick, and 28 in. from centre to centre. The dead flat, or midship section of the hull, is equidistant from stem and stern post, but the centre of gravity of the hull is 17 inches aft the midship section, caused by an overhanging transom stern.

Diameter of cylinder, 3 ft. 4 in.; length of stroke, 12 ft.; diameter of water-wheel, 28 ft. 10 in.; face of paddles, 8 ft.; number of paddles in each wheel, 28; depth of paddles, 2 ft. 2 in.; the paddles dip under 4 in.; average number of revolutions, 24 per minute; average pressure of steam, 45 lbs., using Stevens' cut-off, and admitting steam 6 ft. 6 in. of the stroke. Best speed, 20 miles per hour: she has two boilers, 28 feet long, 6 feet 6 inches diameter of shell, and fronts of the same width; two furnaces in each boiler, 34 inches wide and 7 feet long, with rising flues and single return; a steam chimney on each boiler, 32 inches inside diameter, 8 feet 6 in. high, with a steam-space of 8 inches outside. The consumption of anthracite coal is 2000 lbs. per hour; the boilers are supplied with air for combustion from two blowers, 54 inches in diameter, and 24 inches wide, which discharge into an air-tight fire-room, and from thence to the ash-pit, and are capable of making 70 lbs. of steam for 10 hours, the engine cutting off at $6\frac{1}{2}$ feet.

Centre Line.

Midship Section.

This boat may be considered a superior specimen of work, whether we examine the machinery or the hull. The former was built by Messrs. H. R. Dunham and Co., of the Archimedes Works, in New York, and the boat is named after their engineer, Mr. Belknap. The hull was built by Colyer, the same that built the *America*: his models are well known for speed.—*Franklin Journal.* B.

REPORT OF THE COMMISSIONER OF PATENTS, TO THE SENATE OF THE UNITED STATES, ON THE SUBJECT OF STEAM BOILER EXPLOSIONS.

(Continued from p. 222.)

"Having thus glanced at a few of the more prominent mechanical devices for the prevention of explosions, some of which claim to be important improvements upon the safety apparatus of the steam engine, the undersigned does not feel called upon to express any opinion as to their relative merits, still less to point out any particular apparatus as best calculated to meet the wants of the public. Even if any one of these contrivances could be singled out with certainty as the best existing plan for obviating danger of explosion, it is not believed that its employment ought to be recommended as the subject of compulsory legislation by Congress. These plans are all before the public, who have a vital interest in selecting the one best calculated to secure their lives and property. Nothing can add to the force of motives drawn from the love of money and the desire of self-preservation. If the apparatus selected for government protection were not the best, the law would be evaded, or openly disobeyed; if it were the best, and yet not a perfect safeguard, its protection would operate as a check upon the ingenuity of inventors by taking away its strongest stimulus. The source of danger, in the opinion of the undersigned, is to be looked for elsewhere than in the imperfection of the engine or its appendages, and the legislative remedy ought to be applied in a different quarter.

"The legal remedies for explosions, then, are the next subjects to be considered. These are either preventive or penal. The preventive measures are such as relate to the qualities of the engine, and the qualifications of those who are to inspect or manage it. The penal provisions are those which provide for actions, civil or criminal, against the parties through whose fault injury has been committed.

"Before submitting any suggestions or recommendations, 'with reference to further legislation by Congress for the prevention of the explosion of steam boilers,' it is deemed proper to lay before the Senate the objections which are entertained by practical men to the existing laws, together with the modifications of them which they propose.

"The laws now in force are those of July 7, 1838, and March 3, 1843. The third section of the law of 1838 gives to the 'district judge of the United States, within whose district any ports of entry or delivery may be,' the appointment of inspectors to make inspections of the hulls, boilers, and machinery of 'vessels propelled in whole or in part by steam.'

"It is objected to this provision, that the district judge is not likely, from the character of his pursuits and associations, to be able to form a very correct estimate of the qualifications of applicants for the office. In some cases his residence is remote from the port where the duties of the inspectors are to be performed, which renders it improbable that he could have any personal knowledge of the character of applicants, or be able to exercise over them any supervision. It is, therefore, proposed to place the appointing power in the hands of a resident, or residents, of the port where the inspections are to be made, and with individuals the character of whose pursuits is calculated to render them competent judges of the qualifications of the applicants for the place of inspector.

"Again, this section makes no provision for a separation of the duties of inspecting hulls, and inspecting boilers and machinery, but renders any inspector competent to perform both. The qualifications necessary to perform one of these inspections are quite different from those requisite to perform the other. The inspector of hulls should be a man well acquainted with boat-building, whereas the inspector of boilers and machinery should be a sound practical engineer. The union of both these offices in the person of each inspector renders it almost certain that one of the duties will be ill-performed, and gives rise to a rivalry and competition in the highest degree prejudicial to the character of the inspection; for there is but one voice as to the existence of the fact, that steam-boat owners and captain

will always employ in preference the inspector who is least faithful in the performance of his duty. By dividing the offices, and thus taking away competition, the inspector would be more independent and more likely to make his inspection thorough. This end would be still farther secured by requiring that all boats in a certain trade should be inspected at a certain port, thus limiting each boat to a single inspector.

"A recommendation, which contemplates the examination of inspectors by a board consisting of the best practical engineers, has been made with great unanimity by all who have proposed modifications of the law. It is also proposed that the same board should decide on the qualifications of engineers, who should not be allowed to hold the office without a certificate from the board of examiners; nor should boat-owners or captains be permitted to employ engineers without such certificate.

"The elevation of the character and standing of the engineer becomes, in the views of the subject taken in the former part of the report, a matter of primary importance to the safety of the public. It is a fixed principle of human nature that men become worthy of confidence and respect in proportion as they feel themselves to be respected. Services which are deemed worthy of the special notice of the law, which are well paid, and to perform which a man must go through a course of preparatory training, and submit to a rigid and impartial examination, assume, in his eyes, an importance which they cannot have when he receives his appointment without inquiry as to his qualifications, and is left to perform its duties as he may. In the former case, the right performance of duty becomes a point of professional pride; in the latter, it sinks to a mere question of pay. The unanimity with which the recommendation above alluded to has been made, of a board of examiners before whom all candidates for inspectorship, or the office of engineer, should be required to pass before obtaining the office sought, entitles it to respectful consideration. In relation to another department, where the health and life of individuals are placed under the professional care of medical men, the government has acted upon the plan here recommended. The evidence of having received a medical education, and the diploma of the most eminent medical school, are not considered a sufficient guaranty. The candidate for a medical appointment, in either arm of our military service, must pass a searching examination, by an able board of examiners, as to his knowledge of the theoretical and practical parts of his profession; yet the number of lives dependent upon the skill and care of any one of these officers is not for a moment to be compared with those that hang upon the doubtful competency of an inspector of steam boilers or a steam-boat engineer. The ignorance of the former may send men to their graves *singulatim*, and by retail; but one act of carelessness in the latter may cause the instant destruction of hundreds. If the magnitude of the interest at stake is a sufficient reason for the examination in the one case, it is, *à fortiori*, a reason in the other. Faithfully administered, there can be little doubt that such a system would tend to give new dignity to the employment, by establishing a higher standard of qualification.

"The fourth section of the law prescribes the duties of the inspector of hulls, and regulates his fees. The inspection of hulls by a government officer is thought unnecessary, inasmuch as the insurance offices, which have a deep stake in the security of the vessel, have competent inspectors, appointed by themselves, whose examination, is much more rigid than that of the government inspectors; and it is said to be no uncommon case for a boat to be condemned by the insurance-office inspector which had just received the certificate of the United States' officer. It is urged, moreover, with some force, that vessels which navigate the ocean, the soundness of whose hulls is a matter of much greater consequence to the safety of the travelling world than that of the hulls of steamboats, are not burdened with this tax, but left to the exclusive care of the insurance inspectors. It is proposed, as an additional amendment to this section, that the inspectors should be paid by the government.

"By the fifth section of the law, the inspectors are required to make a certificate as to the soundness of the boilers, and to furnish the master or owner of the boat with a duplicate of the same. If the inspection, as at present conducted, be, as it is represented, a useless tax upon boat-owners, and of no value as a guaranty of the safe condition of the boilers, the certificate can only serve to beget a false, perhaps a fatal, confidence in the minds of the passengers. Such is the opinion expressed by the Cincinnati Association of Engineers. Before the certificate can be of any value, the course to be pursued in the inspection must be plainly laid down, and some exact standard of thickness, strength, &c., be adopted, below which no boilers should be suffered to fall without a denial of the certificate.

"The intervals at which inspections of hulls and boilers are to be respectively performed are regulated by the sixth section of the law. The fact, well ascertained, that the strength of boilers may be so impaired by the misusage of a single trip as to be utterly unsafe, would seem to be a sufficient objection to such a limitation. And yet to subject the owners to frequent inspections at a heavy cost, and which may possibly be in most cases unnecessary, appears to be a measure unwarrantably oppressive, and which would operate most severely upon those who were most worthy of public confidence. Some have gone so far as to recommend the monthly application of the hydrostatic test. To secure the benefit of frequent inspections, while their oppressiveness to owners should be avoided, it has been suggested that the inspectors should receive from the boat their fees for the semi-annual examination, and, in addition, a small salary from the government, in consideration of which it shall be their duty to visit and inspect, without unnecessary delay, each boat that arrives at the port.

"The seventh section requires the safety valve to be opened when the vessel stops for any purpose whatever, under a penalty of two hundred dollars. Such a provision must have arisen from a misapprehension of the consequences that may arise from the adoption of a fixed rule with regard to the opening of the safety valve. If the views advanced in the former part of this report, as to the causes of explosions, be correct, the opening of the valve at a stopping place might, under some circumstances, be the cause of the very accident it was intended to prevent. If the water were low, and the top of the flues overheated, the opening of the valve, causing a violent ebullition or 'frothing,' would throw the water into contact with the overheated metal, thus suddenly generating a quantity of highly-elastic steam, to which the valve could not afford a sufficiently rapid exit, and an explosion would be the necessary consequence. Measures tending to elevate the character of the engineer, and render him more careful and trustworthy, would do away with the necessity for any such interference with the minor regulation of the engine.

"The penalties provided in the twelfth section of the law are regarded as too harsh, and it is found that on that account they cannot be enforced. Juries cannot be induced to subject a man to the penalties of manslaughter for an act of negligence to which they find it impossible to attach the degree of guilt which so severe a sentence would seem to imply.

"The thirteenth section makes the fact of the explosion *prima facie* evidence of negligence in all suits or actions against proprietors of steam-boats for injuries arising to person or property from the bursting of the boiler, &c. This provision, it is urged, raises an adverse presumption upon a fact which it is impossible to deny, and throws upon the defendant the necessity of proving a negative, a task always difficult, and rendered peculiarly so by the circumstances of terror and excitement which always attend these events. The severity of this feature of the law is said to have driven many worthy and enterprizing steam-boat proprietors from the business, and left it in hands less responsible.

"The law of 1843 has exclusive reference to the steering apparatus of 'vessels propelled by steam,' and therefore has no bearing upon the subject of this report.

"Such, then, are some of the objections to the existing law which have been advanced by men who have had the best opportunities of witnessing its practical working. Though it can scarcely be denied that they are, in the main, well founded, yet the undersigned is not prepared to recommend the remedies which are suggested. He is convinced, by as thorough an examination of this subject as his time and the means of information in his possession would permit, that, by descending to the details of management in matters of which it cannot be the best judge, the law subjects itself to the charge of oppression, or lays itself open to contempt. If constructors and engineers could be made competent and careful, there would be no necessity for minute directions, and where they are not so, no legislation can protect the public against the consequences of their misconduct. For it is not to be supposed that a man who would neglect his duty, at the risk of his life, could be induced to perform it by any motives the law could bring to bear upon him.

It is the deliberate opinion of the undersigned that the best remedy for all the evils complained of would be to make a strong appeal to the interests of boat-masters and proprietors, by giving a remedy, where explosions result in injury to persons or property, to the individuals wounded, or to the nearest relative or friend of the killed, in the shape of heavy damages recoverable by action at law. And the undersigned would recommend that, in addition to the personal responsibility of the owners, the boat itself should be held by way of *lien* to respond the damages which may be recovered by the plaintiff; and that, in case the owner is an incorporated company, the members of the company should be held severally as well as jointly liable in their individual capacities. Such a course would bring the most powerful motive to bear to force the proprietors to employ in the construction of boats the best materials, and the most skilful and faithful workmen, and to entrust their management to those engineers alone who can bring the most satisfactory evidence of their competency, carefulness, and good character. Properly constructed, the steam engine is believed to be as free from defects as most human contrivances, and, under careful and intelligent management, as free from danger as the nature of the powerful agent it is intended to controul can allow us reasonably to expect.

"In expressing these views, the undersigned would not be understood as intending to undervalue or discourage the exercise of ingenuity in the multiplication of the means of security, or those investigations of science which tend to develope the *natural causes* upon which these lamentable occurrences may depend. On the contrary, he is convinced that the government cannot more legitimately exercise an enlightened care over the safety of the people than by fostering such ingenuity, and promoting such investigations by providing the means for their prosecution. * * * *

"The main points of this inquiry seem to have been exhausted by the very able report of the committee of the Franklin Institute. Their investi-

gations may be considered as having settled most of the questions to which their attention was directed. There still remain, however, some points not fully determined by that committee, and which have already been alluded to in this report, but which may well be recapitulated here. They are, first, as to the extent to which a local relief of pressure would operate to produce a difference of level in the water in a boiler, and whether an explosion could result from such difference; second, a more full investigation of the repulsion between water and metals heated to a certain temperature; third, the whole subject of incrustations is yet comparatively open as a field for investigation.

"On these points the undersigned takes the liberty of suggesting the institution of an investigation, to be made at the expense of the government, and conducted, as were the valuable labours of the Franklin committee, under the auspices of some recognized scientific association. On the subject of deposits, these experiments should extend to the sediments of all the principal rivers navigated by steam in our country. Aside from their relation to the subject now under consideration, the geological results of such an investigation could not fail to be of great interest and value.

"I have the honour to be, very respectfully, your obedient servant,

"Edmund Burke,

"Commissioner of Patents.

"To the Hon. Geo. M. Dallas,

"Vice President of the United States,

"and President of the Senate."

ELECTRO-TELEGRAPHIC COMMUNICATION:

ON ITS PRESENT STATE IN ENGLAND, PRUSSIA, AND AMERICA. BY FRANCIS WHISHAW, ESQ.

1. *The English System.*—The English telegraphic system may be divided into two classes—viz., 1st, the railway telegraphs; and, 2nd, the commercial telegraphs. The railway telegraphs are used merely for the purpose of sending communications relating to railway matters; but the commercial telegraphs, belonging to the Electric Telegraph Company, are used by the public for the transmission of public and private communications, at fixed rates of charge.

The commercial telegraphs, belonging to the Electric Telegraph Company, extend over 1,541 miles, besides a few branch lines.

In addition to the above, the South Eastern Railway Company have established commercial telegraphs on 152 miles.

Besides the lines of telegraph belonging to the Electric Telegraph Company and the South Eastern Railway Company, there are other railways furnished with Cooke and Wheatstone's Telegraph.

The whole extent may be stated at about two thousand miles. The construction of the telegraphs, chiefly used in England, may be thus described:—Along the sides of the various railways (for by this system it is wise to have the telegraph wires protected, as far as possible, by a constant supervision) wooden vertical posts of fir timber are ranged at convenient distances. Each post is furnished with an insulator of earthenware, through which the wires are drawn, to prevent their connection with the wooden posts. The wires are of stout galvanised iron, which are carried from one end of the railway to the other, except in passing through tunnels, or under bridges. In such cases, the insulators are attached to the brickwork; and thus the wires are prevented from being in contact with the brickwork. Each post is furnished with a lightning conductor, and is also capped with a wooden roof, with dripping eaves to throw the rain water from the wires. At each end of the telegraphs, the line wire is connected with an earth battery, consisting of a large plate of zinc or copper, buried in the earth—the object of which is to avoid the necessity of a return wire, which in the first telegraphs in England was made use of. At the various stations, one or more of Cooke and Wheatstone's needle instruments are set up, and which are connected with the line wires and batteries by wires of smaller size, generally covered with silk or cotton, which is easily destroyed by the alternations of weather, and, therefore, is objectionable. Each telegraph on this plan has two wires. The batteries used are of the most simple form, consisting of a trough, divided into any number of cells, according to the power required. Alternate plates of zinc and copper are connected throughout the pile, which dip into sand, saturated with dilute sulphuric acid—the use of the sand being to prevent waste of the acid in the battery, when required to be sent from one station to another ready charged. The signals are given by means of the needles, placed in front of a dial, on which are written, or engraved, the letters of the alphabet, being moved either to the right or to the left. Each needle in *front* of the dial is placed on the same axis as a magnetic needle *behind* the dial, which latter is suspended freely in a space, surrounded by a coil of wire, through which coil, when the current is transmitted either in one direction or the other, the needle is deflected either to the right hand or to the left, as may be desired; so that, by a certain number of movements of each needle, and by the combination of the movements of both, every letter of the alphabet, or any numeral, is given. As many as thirty letters, under ordinary circumstances, are thus transmitted in a minute; but by expert manipulators many more. Although the requisite movements are easily learned, yet it requires many weeks for a telegraphist to work the needle instrument sufficiently well to be entrusted with a communication of any value, whether for railway or commercial purposes; moreover, it is requisite that the two persons communicating with each other should be equally advanced in the required manipulations. Some of the boys employed by the Electric Telegraph Company, have acquired wonderful rapidity in the transmission of messages; while I have known many persons give up the occupation altogether, although having no other employment to resort to. In case of a telegraphist attending the needle instrument being suddenly disabled by illness or otherwise, great inconvenience must be experienced, by reason of no one being at hand to take his place; whereas by other instruments, as that of Siemen's, &c., which can be worked by man, woman, or child, at five minutes' notice, this inconvenience is done away with. The exposure of the wires to atmospheric influence—to storms of snow, as lately experienced on the South Eastern Railway—to the destructive effects of trains running off the way, and to the destruction of the wires by malicious persons (rewards for whose apprehension have frequently been offered), are all fatal objections to the present English system ever becoming universal. Moreover, the expense to railway companies and others is a sad drawback to the further extension of this system in Great Britain and Ireland—for the railways of which alone an extension of at least 2,000 miles is still required. The average charge for an electric telegraph, with two wires, as hitherto furnished to the various railway companies in England, may be stated at not less than 150*l*. per mile; added to which an annual sum must be calculated on for keeping it in order, and reinstating, when necessary, the wooden posts, &c. The charge for transmission of communications by the Electric Telegraph Company's telegraphs in England, is at the rate of one penny per mile for the first fifty miles, and one farthing per mile for any distance beyond one hundred miles. The South Eastern Railway Company's charges for telegraphic communications are even much higher than those of the Electric Telegraph Company. Thus twenty words, transmitted eighty-eight miles, is charged the large sum of 11s.; whereas the same length of communication for the distance of 100 miles is only charged 6s. 3d. by the Electric Telegraph Company.

These facts are brought forward in order to show that not only do telegraph companies derive much greater advantages, but also the public at large, by the construction of telegraphs on a more economical system. This brings me to the *American* system of telegraphs, which are already extended over 10,511 miles.

These telegraphs have been constructed at the expense of several private companies, and are all returning about six per cent. and upwards. The longest line belonging to one company is from Washington to New Orleans—a distance of 1,716 miles. Morse's printing telegraph, requiring only one wire, is chiefly used throughout the United States. By this contrivance, marks, consisting of lines and dots, scratched and pricked on slips of paper, are made to represent the letters of the alphabet. The slips of paper, while the operation of printing, as it is called, is going on, continue to move forward by means of clockwork; 1,000 words per hour may be transmitted by this telegraph. House's printing telegraph, and others, are also in use on many of the lines. The wires are of galvanised iron; as in the case of the

English telegraphs, they are suspended on wooden posts, chiefly by the side of the railway; but in many parts of the States, where railways do not exist, the wires are suspended across the prairies without any protection whatever, except the general good will of the people towards every improvement for the benefit of the country at large. The consequence is frequent damage, so that, although the American system is economical in construction, the average being about 30*l.* per mile, yet if a more secure and substantial system had been adopted at less than double the cost, a great saving would ultimately be effected by the continual repairs necessary being avoided, besides the reinstatement of the rough wooden poles at periodical intervals. The advantages of an economical system of telegraphs, however, are abundantly proved by the working of the lines of telegraph throughout the States and Canada, as the poorest person is enabled, by the very low rate of charges, to use any of the telegraphs in America, even for domestic inquiries. By reference to the scale of charges submitted, it will be seen that a communication of twenty words, conveyed over a distance of upwards of 500 miles, is only *four* shillings; whereas, by the English scale of charges, the same communication, at the same rate, would not be transmitted sixty miles, or less than one-eighth the distance; and by the South Eastern Company's charges, not twenty miles, or one-twenty-fifth of the distance. Again, a communication of ninety words in America may be transmitted from Washington to New Orleans (1,716 miles), for 41s. 8d.; whereas, by the English Telegraph Company's charges, the same communication would only be transmitted rather more than 200 miles, and by the South Eastern Company's charges, under 100 miles.

I now come to the *Prussian* telegraph system, which may be characterised as simple, substantial, effective, and economical. In 1844 a Royal Commission was appointed, for the purpose of taking into consideration the various telegraphs which had then been brought forward. This commission consisted of General Von Etzell, Major Von Schmeling, Geheime Rath Mellen, Professor Dove, and Regierungs Rath Nottebohm. Certain experiments were made under the direction of the Commission so appointed; among others, that of placing a copper wire, insulated by means of gutta percha, underground, on the railway between Berlin and Grosberin, a distance of 11·70 English miles. The result of this experiment proving satisfactory, it was determined by the Government, on the 18th July, 1848, to construct lines under the direction of Col. du Vigneau, R. R. Nottebohm, and Post-Inspector Gottbrecht, the immediate superintendence being committed to M. Nottebohm, who is also Government Director of the Prussian railways.

The whole length of the Prussian States' telegraphs at present amounts to 1492·92 English miles. Of this length 196.56 miles are on the above ground plan, until the railway from Frankfort to Eisenach is completed; the rest entirely underground. As soon, however, as the railway is completed, the wire will be placed underground the whole distance to Frankfort. One copper wire, corresponding with No. 14 Birmingham wire-guage, and coated with gutta percha, is laid in the ground two feet below the railway, whether in cutting or embankment; but in passing over bridges or viaducts, the whole is further protected by iron piping. In passing under rivers, as at Cologne, chain pipes are used. The rivers Spree, Havel, and Elbe, are also passed in a similar manner. At the terminus of each line of telegraph an earth battery is used, consisting, in most cases, of a zinc plate, six feet long, two feet six inches broad, and one-eighth inch thick. The instruments and batteries are all connected by wire, coated with gutta percha, and of the same substance as the line wire itself. The instruments used are those, first, of Morse; second, of Siemens; third, of Kramer. The batteries are entirely those of Daniel. In all the principal telegraph offices a printing instrument and a colloquial instrument are used, but each, in turn, is worked by the one wire only, notice being given to the effect that the one or the other is about to be used, according to circumstances. Morse's is the printing telegraph employed, differing very little from that used in America. Those of Siemens and Kramer are both colloquial telegraphs, but Siemen's is chiefly used. There are altogether 35 stations already connected by the one-wire underground plan. The whole cost per English mile, from detailed estimates, furnished to me by M. Nottebohm, is under 40*l.* per mile. Besides the Government lines of telegraph, most of the railway companies in Prussia have also their own telegraphs, but which are constructed according to the American system—namely, one wire suspended from post to post along the railways; the average cost of constructing the telegraphs on this plan is under 20*l.* a mile. A telegraph of this construction extends across the country from Hamburgh to Cuxhaven, a distance of eighty miles; but the disadvantages of wires being exposed are very serious, and were fully shown during the late insurrections. The telegraphs on this plan were destroyed more than twenty times by the insurgents, being easily got at; whereas, where the wire was underground, time was required to discover its position. Besides destruction from malice, the wires above-ground, near Brunswick, were destroyed by lightning, as also the wooden posts and guard-houses, where connected with the wire. On the Cologne and Minden Railway, part of the telegraph wires were destroyed by lightning, near Gutersloh. Between Eisenach and Cassel the instruments were also detroyed by the same means. All these disadvantages are got rid of by the Prussian Government system, which, although not so cheap in first cost as the American system, yet is safer when constructed—is altogether more substantial—and as yielding all the advantages, without the disadvantages, of the English and American sytems, is likely to become the standard for all future telegraphs that may be constructed, both at home and abroad.

SANITARY REFORM.

"When you have no case (said a venerable barrister to his pupil), abuse the opposite counsel." The opponents of the removal of the Smithfield Nuisance are reduced, we rejoice to see, to this last resource. One of the common councilmen, immortalized in the *Times*, as "Defender of the Filth," seems to have taken a leaf out of the aforesaid gentleman's book; for at a meeting of the common council on the 10th inst., his strongest point seemed to be that certain of his opponents were connected with the Islington Market, and, therefore, *of course*, must have some mercenary motive in promoting the removal of the market from Smithfield. Besides, he knew, for a fact, that there were *three* properties, which would be offered as sites for a market! "He could not conceal from himself that there must be something more than met the eye, when three proprietors were desirous of offering their property." Why, what a horrible place a market must be, if only *three* proprietors could be found in this overgrown city, willing to dispose of their land for such a purpose! Voluntary blindness is proverbially intense, and this is about as good an example as we ever met with. One witness knew "of people who were afraid that the market would come to their neighbourhood," (and well they might be, judging from the present state of Smithfield.) "Therefore, (argues the civic Solon), "it had better stop where it is!" These gentlemen, however, who think Smithfield such a salubrious place, take good care, as Mr. Norris observed, to live a long way from it.

The following facts are the best commentary:—

A few weeks back the market was crammed with 4,600 cattle, being 1,850 more than there is stallage room for—that number, of course, being left loose, and restrained only by stick and goad.

The receipts from the tolls are £4,000 a-year,—the expenses from £6,000 to £7,000.

In London generally, the public houses are to other houses, as 1 to 25. In the neighbourhood of Smithfield, as 1 to 5.

The number of police cases from Smithfield, during 1846, were 305.

The Smithfield district presents in the Registrar General's returns, a rate of mortality nearly double that of the central city district, which bounds it on the east; more than double that of the Strand on the west, and more than *four* times that of the Clerkenwell district on the north—in fact, worse than St. Giles.

So much for the convenient, profitable, moral, and salubrious Smithfield Market.

THE SOCIETIES.

INSTITUTION OF MECHANICAL ENGINEERS.

PROCEEDINGS.

(Continued from page 227).

The following paper, by Mr. Benjamin Gibbons, of Shut End House, near Dudley, was then read,

On a Pneumatic Lift.

The Pneumatic Lift described in the present paper is employed to raise the ore, coal, and limestone, for charging four smelting furnaces at Corbyn's Hall New Furnaces, near Dudley.

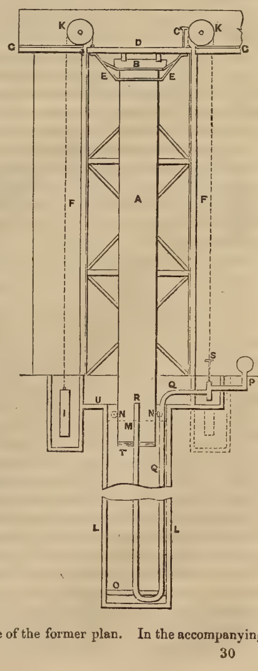
In some districts the levels of the ground admit of the furnaces being charged by wheeling the materials on a level platform from higher ground to the top of the furnaces, but in general these have to be raised by machinery to the level of the top of the furnaces, the height raised being about forty to fifty feet. The usual plan of raising the materials is by an inclined plane, which rises from the ground to the top of the furnaces at an angle of about thirty degrees; there are two lines of railway upon it, and a travelling platform on each line, drawn up by a steam engine by means of a chain passing over a pulley at the top of the inclined plane. The two platforms balance one another, one of them descending while the other ascends, and the top of each platform is made horizontal and works level with the ground at the bottom and with the stage at the top of the furnaces, so that the barrows of materials are readily wheeled on and off the platforms; several barrows are carried by each platform. A rack is fixed on the inclined plane along the centre of each line of railway, and a catch is fixed on the moving platform which falls into the teeth of the rack in ascending, for the purpose of stopping the platform and preventing an accident in case of the chain breaking; but the use of this catch is found to be inconvenient in practice, and is generally omitted. There is a difficulty in stopping the platform at the required level, and the inclined plane is objectionable, from the space which it occupies, and the expense of its construction.

Where the inclined plane cannot be employed, the power of the steam engine is not employed directly to draw up the materials vertically by a chain, because of the difficulty in working it conveniently and safely, to stop the platform at the correct level for wheeling the barrows on and off, and prevent the risk of serious accident by the chain breaking, particularly in the night work. At some iron works an endless chain is used for this purpose with a series of buckets fixed upon it, which are filled with the materials at the bottom, and empty themselves into the furnace by turning over at the top. This lift is not suitable for supplying more than one furnace; and, when there is more than one furnace, it is most advantageous to employ a lift that will take up the materials in the barrows, ready for wheeling at the top to the different furnaces.

Another plan for lifting vertically is by means of a water balance. The platform on which the barrows of materials are raised is suspended by a chain passing over a pulley at the top, and a bucket is attached to the other end of the chain; the platform in descending draws up the empty bucket, and when the platform is loaded the bucket is filled with water until it overbalances the loaded platform and draws it up. There is an important objection to this plan, that the bucket descends with an accelerated velocity, and a friction break has to be used to check the velocity to prevent a violent concussion on stopping its *momentum* at the end of the descent; this causes a risk of accident from breakage of the chains, and the friction break is also liable to derangement and expensive repairs.

At the Level Iron Works, near Dudley, an instance occurred where a vertical lift had to be introduced in consequence of the furnaces being raised 16 feet in height; there were two furnaces, originally 34 feet high and raised to 50 feet high, and at the original height the materials were wheeled on the level to the top of the furnaces. When the height of the furnaces was increased, the materials were required to be raised 16 feet, and a vertical lift was necessary in consequence of the situation being so much confined by a canal as to prevent the adoption of an inclined plane. For this purpose, the author of the present paper constructed a pneumatic lift, worked by the pressure of the air from the blowing engine that supplied the blast for the furnaces. This lift was designed with the object of avoiding the objections to the plans of vertical lifting previously in use, and obtaining a safer and more economical application of power.

This pneumatic lift consisted of a heavy cast-iron cylinder, 4 feet 4 ins. diameter inside, closed at the top, and inverted in a well filled with water, in which it was free to slide up and down like a gasometer. This cylinder was suspended from the top by a chain fastened to the circumference of a pulley which was fixed on a horizontal shaft above the level of the top of the furnaces. A pipe from the air-main was carried down the well and turned up inside the cylinder, rising above the surface of the water; and when the blast was let into the cylinder through this pipe, the cylinder was raised in the water by the pressure of the compressed air against the top: this pressure was about 2 lbs. per square inch. A platform for raising the barrows of materials was suspended by a chain from another pulley on the same shaft as the former pulley, and the platform was guided in its ascent by vertical framing. The cylinder was heavy enough to draw up the platform with the load upon it by descending into the water when the blast was withdrawn; and the empty platform was lowered by admitting the blast into the cylinder, and thus raising it. The cylinder was lowered again by opening a valve which let out the compressed air, and its velocity of descent was regulated by opening this valve more or less. The velocity of the platform, both in rising and falling, was completely under command, by regulating the opening of the valves for admitting or letting out the compressed air; and the velocity was gradually checked towards the end of each stroke with certainty and ease, so as always to stop the platform without concussion. The height to which the cylinder was raised was only five feet, and the two pulleys were made of different diameter so as to raise the platform 16 feet: the load raised upon the platform was about half a ton. This pneumatic lift has now been in constant work for 39 years, and has worked quite satisfactorily during the whole time: it has not required any repairs, except renewal of the chains and repair of the rubbing parts. An accident happened once by the chain breaking whilst lifting, and the platform fell about five feet, causing a shock to the man going up with it, but no injury was done to the machinery.



An improvement on this pneumatic lift was made by the author of the present paper, in constructing a lift on a considerably larger scale at the Corbyn's Hall New Furnaces: this is shown in the accompanying drawing, and was constructed at the time of building the furnaces. The height to which the materials have to be raised is 44 feet 6 inches, and the present plan was designed to prevent the risk of an accident occurring through the breaking of a chain. There are four furnaces supplied by this lift, which is fixed between two of them, and the four furnaces are connected on the same level by the staging at the top, on which the barrows of materials are wheeled from the platform of the lift.

In this lift the platform for raising the barrows of materials is fixed on the top of the air cylinder, and it is raised by the pressure of the blast, the action being the reverse of the former plan. In the accompanying

drawing the lift is shown at the highest position. A is the air cylinder, which is 5 feet 6 inches diameter and 51 feet 6 inches long, constructed of rivetted wrought-iron plates averaging $\frac{1}{4}$ inch thick, the plates being $\frac{5}{16}$ inch thick in the lower part and $\frac{3}{16}$ in the upper part: the cylinder is closed at the top and open at the bottom, and has a throttle-valve B, 8 inches diameter, in the centre of the top, which is opened by pressing down the foot-lever C fixed upon the platform.

D is the platform on which the materials are raised: it consists of planking carried on timber bearers, which rest upon the edge of the cylinder top, and upon four wrought-iron brackets E E carried out diagonally from the cylinder to steady the platform, and fixed to two hoops passing round the cylinder.

F F are four timber guides placed at the corners of the platform, and connected at top to the level stage G G upon which the barrows of materials are wheeled to the mouth of the furnace H. These guides are faced with angle-iron on the inner edge, and a corresponding angle-iron is fixed in a notch at each corner of the platform D, to slide easily up the guides: the height that the platform rises is 44 feet 6 inches.

Four cast-iron balance weights I I are suspended outside the guides F F by chains which pass over the pulleys K K in the top framing, and are attached to the four corners of the platform D. These four balance weights weigh about $6\frac{1}{2}$ tons, and the air-cylinder and platform together weigh 7 tons, leaving an unbalanced weight of about $\frac{1}{2}$ ton to bring down the air-cylinder and empty the platform.

The air-cylinder A descends into a well L L which is filled with water to the level M, and it is guided by four rollers N N 6 inches long and 7 inches diameter, each of which works against a strip of bar-iron rivetted on the cylinder, 4 inches wide and the whole length of the cylinder. At the bottom of the well a foundation of timber O is fixed, to form a stop for the cylinder in descending, and the cylinder rests upon the timber when at the lowest position by a ring of angle-iron rivetted round the bottom edge. The cylinder is stopped on rising to the top by a wood block fixed on each of the four guide-posts F F, which stop the platform at the level of the top stage G G.

P is a cast-iron pipe 7 inches inside diameter, which conveys the compressed air from the air-main, and the pipe Q of the same size carries it into the cylinder, passing down to the bottom of the well between the cylinder and the side of the well, and rising up the centre of the cylinder: the end of the pipe at R is open, and stands above the level of the water.

The valve S regulates the admission of the compressed air into the cylinder when the platform is raised, and also lets out the air from the cylinder when it is lowered. This valve consists of a plug or deep piston sliding in a vertical-bored cylinder of the same diameter as the air-pipe, which is closed at the top and open at the bottom. When the plug is in the lowest position, as shown in fig. 1, it closes the bottom of the cylinder, and the communication is opened between the pipes P and Q, and the compressed air passes into the air cylinder A, and raises it with the platform D, by the pressure of the air upon the top of the cylinder and upon the surface of the water: the pressure of the compressed air is $2\frac{1}{3}$ lbs. per square inch, and the water is depressed inside the cylinder to T and raised to U outside the cylinder, making a difference of level of 5 feet 4 inches. When the platform is required to be lowered, the plug-valve S is drawn up to the top, closing the pipe P that admitted the compressed air, and leaving the pipe Q open to the external air to discharge the compressed air from the cylinder A: this discharge is accelerated by opening the escape-valve B at the top of the air-cylinder by means of the foot-lever C.

The total pressure of the compressed air against the top of the air-cylinder is $3\frac{1}{2}$ tons; and deducting the unbalanced weight of the cylinder and platform $\frac{1}{2}$ ton, this gives an available lifting power of 3 tons. The load of materials raised varies according to the working of the furnaces, and the average load of materials raised each time is $1\frac{1}{2}$ tons, exclusive of the barrows and men, or about 2 tons gross weight. The lift is raised 16 times per hour during 20 hours in each day of 24 hours, or once in $3\frac{1}{3}$ minutes; and the total weight of materials raised each day is about 500 tons. The time of raising the platform from opening the inlet-valve to reaching the top is from 50 to 70 seconds, according to the load in regular work; and the time of lowering the platform is from 30 to 50 seconds according to the degree of opening of the escape-valve on the top of the air cylinder: the empty platform can be raised in 45 seconds, and lowered in 25 seconds, with the present size of apertures.

In raising the platform the inlet-valve is kept full open until the platform arrives at 14 inches distant from the top, when it catches a lever which gradually draws up the plug of the inlet-valve, so far as nearly to close the pipe leading to the air-cylinder: this checks the moving power, and causes the velocity of the platform to be so much retarded by the time it arrives at the top, that the platform stops dead against the wood blocks without any concussion being felt. The platform is held firmly up to these stops by the pressure of the air as long as may be required, without any recoil, and without requiring any catches to hold the platform, as it cannot descend in the least unless the air is allowed to escape from the cylinder, and the supply from the air-pipe keeps it full in the case of any leakage taking place. When the platform is raised empty, a wood block turning on a pivot is slipped by the foot under the lever that closes the inlet-valve, so as to begin closing the valve sooner: this is adjusted according to the velocity of the ascent of the platform, and regulates the lifting power so as to prevent any concussion on stopping at the top of the ascent.

When the platform arrives at the top, the men who go up with the barrows, wheel them off to discharge the materials into the several furnaces; and as soon as the empty barrows are brought back, the platform is lowered by drawing up the plug of the inlet-valve to the top, which shuts off entirely the supply of compressed air, and opens the exit below the plug for the air in the cylinder to escape. This is done by the men on the platform at the top by means of a rod from the valve carried up the framing; and the escape-valve on the top of the cylinder is then opened and kept open till the platform is near the bottom, when it is closed and the velocity of the platform is so much checked before stopping that scarcely any concussion is felt at stopping: it can easily be stopped without any concussion.

The velocity of the platform is also gradually checked in descending by the gradual immersion of the cylinder in the water, which reduces the unbalanced weight of the cylinder. The total loss of weight of the cylinder when at its greatest immersion in the water is $\frac{1}{2}$ ton, which reduces the effective unbalanced weight of the cylinder and platform from $\frac{1}{2}$ ton to nothing: but the weight of the four chains amounting to $\frac{1}{8}$ ton is added to the balance weights at the beginning of the descent, and is transferred to the platform at the end of the descent; and the result is that moving power causing the descent of the platform is reduced $\frac{1}{4}$ ton during the descent, being about $\frac{3}{8}$ ton at starting and $\frac{1}{8}$ ton at stopping: this moving power can be altered as required, by altering the balance weights.

This lift was originally constructed to work only two furnaces, and the air pipe was only 5 inches inside diameter, and the time of raising the platform was usually 140 seconds; when the other two furnaces were added it became necessary to add a second air pipe of the same size, for the purpose of working the lift twice as fast; one pipe only is shown in the accompanying drawing, equal in area to the two actually employed. When the lift was constructed it was found that the well could not be made sufficiently water-tight, on account of a slight disturbance in the strata from the getting of the neighbouring mine, and an outer cylinder of similar construction to the air cylinder, was consequently sunk into the well; this outer cylinder having a close bottom, holds the water in which the air cylinder works, like the tank of a gasometer.

The quantity of air blown into the cylinder each time of raising it is 1128 cubic feet, and the total quantity per day of 24 hours is 360,960 cubic feet, or about 12 tons weight of air; the total quantity of air blown by the blast engines is 16,185 cubic feet per minute, and 23,306,400 cubic feet or about 780 tons weight of air per day of 24 hours. The proportion of the total blast that is used by the lift is therefore as 12 tons to 780 tons, or $\frac{1}{65}$ of the whole, and consequently $\frac{1}{65}$ part of the total power of the blowing engines is employed in working the lift; there are two blowing engines employed. The pressure of the blast is $2\frac{1}{3}$ lbs. per square inch, and the total engine power is consequently 165 horse power; and the air consumed by the lift being $\frac{1}{65}$ of the total blast, it follows that $\frac{1}{65}$ of 165, or $2\frac{1}{2}$ horse power, is the power that is actually employed in working the lift; this power being a constant power acting during the whole day instead of acting merely at the times when the lift is rising. The actual power required to elevate the lift, with the average gross load of 2 tons on the platform, or $2\frac{1}{4}$ tons total weight, including the average unbalanced weight of the cylinder and platform, raised 44 feet 6 inches in 70 seconds, is 6 horse power; the greatest

power employed being $3\frac{1}{2}$ tons raised that height in 70 seconds, which amounts to 9 horse power, and the least is $\frac{1}{4}$ ton raised in 45 seconds, amounting to 1 horse power. Thus it appears that the work of 6 horse power occurring at intervals, is performed by a power of $2\frac{1}{2}$ horse power constantly acting.

The total consumption of coal-slack by the blowing-engines is about 13 tons per day of 24 hours, consequently the expense of working the lift is $\frac{1}{65}$ part of this, or 4 cwt. of coal-slack per day, costing about 5d. per day; and as this lift raises 500 tons of materials per day, it follows that 100 tons are raised 44 feet 6 inches high for 1d., or 4450 tons are raised 1 foot high for 1d. The quantity of air required to fill the cylinder of the lift is 1128 cubic feet, and the total contents of the blowing-cylinders for one double stroke is 1056 cubic feet; consequently an increase in the rate of the engines of one stroke per minute is sufficient to raise the lift in 70 seconds, without diminishing the supply of air for the blast of the furnaces.

These two circumstances cause an important economy in working this pneumatic lift; a small power constantly acting is sufficient to do the work, and the sudden application of this power concentrated into a short time causes but a small increase in the rate of the engine. The total cost of this lift was about £500; and the cost of an incline plane lift, including the engine for working it, would be about double that amount.

This pneumatic lift has been in constant work for the last 9 years, and no accident or stoppage has occurred with it, except that the chain of one of the balance weights broke once: the platform stopped with a very trifling fall, and was held in its position by the pressure of the air: no damage was caused, and the lift was got to work again within an hour's time. The only repairs that have been required since it commenced working, are the renewal of the chains of the balance weights and repair of the pulley bearings: the set of chains can be taken off and replaced whilst the lift is standing during the dinner hour, without causing any delay to the work. This is an important advantage, as it is essential to ensure a continued supply of materials to the furnaces, and to avoid any risk of stoppage for repair of the lifting machinery.

The platform of this pneumatic lift cannot fall quicker than the time in which the whole body of air can escape, amounting to 1128 cubic feet; and the greatest leakage that can arise from an injury of the cylinder cannot let it down so rapidly as to cause any damage. The load is supported by an air cushion during the whole time of its ascent, instead of depending on chains or racks, which prevents any risk of its falling. The complete controul over the motion of the platform that is given by the air valve which regulates the entrance and exit of the air, gives the means of checking, stopping, or reversing the motion at any part of the stroke; and it prevents any concussion at the ends of the stroke, although the lift has a quick action, and is stopped dead at each end of the stroke at the exact level required. The friction of the lift is very small, as the cylinder works through a water joint; and in consequence of the low pressure at which it is worked the loss at any leak is very small, and the strain upon the joints is much diminished.

This pneumatic lift is of course applied most economically and conveniently in the case of blast furnaces, where the compressed air can be obtained very economically and without additional machinery; but it is probable that its application may be extended advantageously to several other cases, such as raising railway waggons, or even railway trains, discharging vessels at quays, and various other purposes, and it possesses several advantages which make it deserving of consideration. The low pressure at which it is worked causes great simplicity and economy in the construction and working, the loss at leaks being reduced, and the joints easier kept in order; and the friction is very small, as the cylinder works through a water joint. Where the lift is not required to be always working, but only to be worked at intervals, a further economy could probably be effected by employing a reservoir for the compressed air, to accumulate power during the time that the lift is not required to work, and thus reduce the size of engine requisite for the work; a large capacity of reservoir could be constructed at a moderate expense, on account of the low pressure upon it. It may be mentioned that at the Corbyn's Hall New Furnaces the reservoir of compressed air contains 5,000 cubic feet at the pressure of the blast, $2\frac{1}{2}$ lbs. per square inch, and consists of four wrought iron cylinders from 6 to 8 feet diameter, constructed of riveted plates from $\frac{1}{8}$ to $\frac{3}{16}$ inch thick; and the cost would be about £3 per 100 cubic feet for air reservoirs of this construction.

Mr. Buckle observed, that he had frequently seen this lift at the works of Mr. Gibbons, and could bear testimony to its smooth and exact working and its uniform motion. He was of opinion it might be usefully applied to a variety of purposes, as it was undoubtedly the best description of lift that he was acquainted with for its present purpose.

The Chairman said, it appeared to him to be a very simple and efficient mode of raising the materials.

Mr. Cochrane observed, that a similar lift was employed at his iron works, for which he had been indebted to Mr. Gibbons; it had proved entirely satisfactory, and there had never been any accident with it.

Mr. Gibbons remarked, that his object in bringing the lift before the Institution, was to render it more generally useful; for in his opinion it might be advantageously applied to a great variety of purposes, more especially at railway stations and in the docks. It would be a great convenience for raising and lowering trucks, and for loading or discharging vessels; as the platform could be quickly raised or lowered to any exact level, and could be stopped at any point at pleasure without concussion, and held quite firm in the position, without any danger of falling, as long as might be required.

Mr. Slate thought it was applicable to lifting railway waggons; and considered that a small blowing engine might be advantageously employed for the purpose, working at a much quicker rate than usual, even 700 feet per minute, like the pistons of locomotive engines; the leakage of the piston would then be of much less consequence.

Mr. Cowper suggested, that steam might be available for the purpose of raising the lift where there was not a blowing engine at work; for although there would be a loss of steam by condensation on the surface of the water, that loss would be very small compared to the whole quantity of steam employed, as the surface of the water would become quickly heated by the steam, but the heat would only extend very slowly downwards in the water.

Mr. Gibbons remarked, that he considered there would be a difficulty in applying steam from the difficulty of keeping the joints steam-tight.

Mr. McConnell referred to the use of hydraulic cranes which had been introduced at some railway stations and other places; and observed that it appeared to involve the question of the relative cost and advantage of air and water as the means for communicating the power.

Mr. Gibbons observed, that the pistons necessarily used in hydraulic cranes were liable to get out of order, and were a source of expense and trouble; and there was also a considerable loss of power from friction, which was not the case in the pneumatic lift. He thought that by the latter plan a whole railway train might be raised a considerable height, without the motion being felt by the passengers.

A vote of thanks was passed to Mr. Gibbons for his communication.

The Secretary then read the following paper, by Mr. Fairbairn, of Manchester.

On the Expansive action of Steam, and a new Construction of Expansion Valves for Condensing Steam Engines.

The innumerable attempts that have been made to improve the principle of the condensing steam engine since the days of its celebrated inventor, Watt, have almost all of them proved failures, and have added little if anything to the claims, next to perfection, of that great man's ideas. It would be idle to speculate upon the various forms and constructions from that time to the present, which have been brought forward in aid of the original discovery of condensation in a separate vessel. All that has been done is neither more nor less than a confirmation of the sound views and enlarged conceptions of the talented author of a machine, which has effected more revolutions and greater changes in the social system than probably all the victories and all the conquests, that have been achieved since the first dawn of science upon civilized life.

It would be endless to trace the history of the successful and the unsuccessful attempts at improvement which for the last half century have presented themselves for public approval; suffice it to observe, that no improve-

ment has been made upon the simple principle of the steam engine as left by Watts, and but few upon its mechanism. Among the latter may be enumerated the improvements in the construction and mode of working the valves; and of these the D valve, by the late Mr. Murdock, and the use of tappets, as applied to the conical valves, appear the most prominent and the most deserving of attention.

In the construction of the parallel motion, the application of the crank, the governor, and the sun and planet motions, all of which have risen spontaneously from the mind of Watt, there is no improvement. The principles upon which all of them are founded have been repeatedly verified beyond the possibility of doubt, and their mechanism is at once so exceedingly simple and so ingeniously contrived, as to limit every attempt at improvement in those parts of the steam engine. What appears to be the most extraordinary part of Mr. Watt's engine, is its perfect simplicity, and the little he has left to be accomplished by his successors.

It will be in the recollection of most persons conversant with the steam engine, that the hand gear for working the valves by the air-pump or plug-rod, gave a self-acting and continuous motion to the machine; and the facility which these means afforded for moving the engine in any direction and at any required velocity, gave it a degree of docility and power beyond the expectations of its most sanguine admirers.

For a considerable length of time the hand gear was the best and most effective mode of applying the motion of the steam engine to the valves; subsequently the oscillating and revolving tappets, fixed upon a shaft and driven by wheels or an eccentric, came into use, and by means of vertical rods communicated motion to the valves, and thus a similar effect was produced as by the hand gear; next came Mr. Murdock's D valve and eccentric motion, which for simplicity has never yet been equalled. The D valve, and the flat plate valve, are nearly synonymous, with this difference only, that the D valve presses with less force upon the face, and consequently works easier than the flat valve, which in every case is exposed to the full pressure of steam. It is true that means have been adopted to obviate this objection in large engines, by a preparation on the back of the valve, which is made steam-tight, and by a communication with the condenser, a vacuum is formed over a proportionate area of surface, sufficient to equalize the pressure and admit an easy motion of the valve.

The expansive principle upon which steam engines are now worked, and the economy which this system has introduced in the expenditure of fuel, has effected considerable changes in the working of the valves, and has rendered the D and plate valves almost inadmissable for such a purpose. To the skill, ingenuity, and careful attention of the Cornish engineers, we are indebted for many of the improvements connected with the use and application of expansive steam; and taking into account the high price of coals, and the urgent necessity of economy in those districts, which combined with a system of registry and encouragement held out by premiums, as described by Mr. John Taylor, we may reasonably conclude that other parts of the kingdom have been greatly benefitted by the excellent examples set before them by the Cornish miners and engineers.

For a great number of years, and up to a recent period, the economy of steam and the working of the steam engine expansively, were but imperfectly understood in the manufacturing districts; and although the Cornish miners set an excellent example and exhibited a saving of more than one-half the fuel, there were nevertheless few, if any attempts, made to reduce what is now considered an extravagant expenditure in most if not the whole of our manufactories. But in fact the subject was never brought fairly home to the millowners and steam navigation companies, until an equalization or reduction of profits directed attention to the saving attainable by a different system of operation.

Ten years ago, the average or mean expenditure of coal per indicated horse power was computed at from eight to ten lbs. per horse power per hour, but now it is under five lbs. per horse power per hour in engines that are worked expansively, and even then they are far below the duty of a well-regulated Cornish engine, with averages from two-and-a-quarter to five lbs. per horse power per hour.

This difference in the consumption of coal may be attributed to two causes—first, the conditions under which the duty of the two engines (that of the Cornish miner and the manufacturer) are respectively performed. The first being chiefly employed in pumping water, has the benefit of alternate action in overcoming the *inertia* of a large mass of matter, which when once in motion is easier continued, for a definite time, than a continuous power of resistance, such as exhibited in corn and cotton mills. Another cause is the greater care and attention which the Cornish-man pays to his boilers, steam pipes, &c.: they are never left exposed, but are carefully wrapped up in warm jackets and well clothed, to prevent the escape of heat. Even at the present day, it is lamentable to see (in the coal and iron districts) the great and extravagant waste that is continually going on, for want of a little considerate attention in this respect: the only excuse is the cheapness of the fuel—but that is not an excuse, for if one-half can be saved, and coal could be got at 1s. per ton, it is certainly desirable to save sixpence out of the shilling, when that can be accomplished at a trifling expense. But one of the chief, if not one of the most important, reasons for the exercise of economy in fuel, is the reduction of profits on articles manufactured by power: under these circumstances, a saving in coal becomes a consideration of some importance: and to these reductions alone may be traced the powerful stimulus which of late years has been prevalent in that direction. The low rate of profit in manufacturing operations, and a desire to economise and reduce the cost of production to a minimum, has been of great value in its tendency to improvement in the economy and efficient use of fuel, and also to the use of high pressure steam and its expansive action when applied to the steam engine. In France and most other parts of the continent this system has been long in use; and although its effects as well as its economy have been long known in this country, it was only within the last few years that the benefits arising from it were appreciated. For a great number of years a strong prejudice existed against the use of high pressure steam, and it required more than ordinary care in effecting the changes which have been introduced: it had to be done cautiously, almost insidiously, before it could be introduced. The author of this paper believes he was amongst the first in the manufacturing districts who pointed out the advantages of high pressure steam, when worked expansively, and for many years he had to contend with the fears and the prejudices of the manufacturers, before the present system of economical working was adopted.

The first attempt was by improvement in the construction of boilers, and subsequently in the valves of the steam engine, adapted to either low or high pressure steam when worked expansively; the latter of which it is the principal object of the present paper to develope.

The expansive action of steam has been variously estimated by different writers, but all seem to agree in opinion that a considerable saving is effected by that process. It therefore becomes a question of importance in a community whose very existence almost depends upon the steam engine, how to work it advantageously, and at the least possible cost. The great variety of schemes and forms which have been adopted for the attainment of these objects have been exeeedingly various, ingenious, and interesting; and the investigation of the different theories and applications that have been submitted for public approval, would form an exceedingly attractive if not a useful history of the various discoveries to which we are in a great measure indebted for the present improved construction of the steam engine.

The elastic force and expansive action of steam were well known to Mr. Watt and some of his immediate contemporaries and successors, such as Smeaton, Cartwright, Woolf, Trevithick, and others; but the fears entertained of explosion at that early period, and the difficulty of constructing vessels strong enough to contain high pressure steam, were probably the greatest drawbacks to its introduction. Woolf and Trevithick were probably among the first to grapple with this dangerous element; and the former in order to economise fuel, introduced the double-cylinder engine, whereby a great saving was effected by increasing the pressure of steam in the boiler, and allowing it to pass from one cylinder to another of three or four times the capacity, by which its volume was expanded, and by these means a saving was effected and an extra duty performed. If, for example, taking a double-cylinder engine, the high pressure cylinder being one-quarter of the capacity of the cylinder from which the steam is condensed, there will be for one cylinder full of steam an expansion of four times its volume, this of course with a diminished pressure in the ratio of the capacities of the two cylinders. Comparing this with a similar process in a single cylinder, equal in capacity to the two cylinders, and fitted with a well-constructed apparatus, regulated so that only one-fifth of the contents of the cylinder (equal in capacity to the small cylinder on Woolf's plan) is filled with steam of equal density, and the remaining four-fifths (equal in capacity to the larger cylinder) is allowe for expansion, it is evident that the communication being

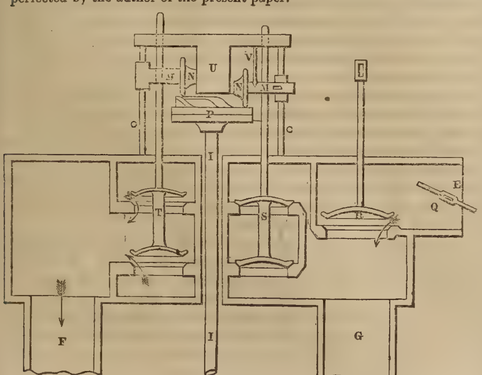
thus suddenly cut off from the boiler after the piston has been urged through only one-fifth of the length of the stroke, the expansive force is then used in completing the remaining four-fifths of the stroke, and the result must be nearly the same as that obtained with the two cylinders on Woolf's plan. The advocates of Woolf's system, however, insist upon its superiority, not from the actual force given out (which is rather in favour of the single cylinder than the double, in consequence of increased condensation in the steam passage between the two cylinders), but from the superior action and greater regularity of motion which in the former case is produced. To some extent this is the case, but not to any appreciable amount, provided the fly-wheel is well-proportioned to the pressure and power at which the engine is worked. In the double engines which are now in common use, that is, when two single engines are coupled together with the cranks at right angles to one another, there is less occasion for a heavy fly-wheel, as the effect of a large expansion is less felt, if not effectually neutralized. The results, therefore, of the double-cylinder engine and the single engine working at equal rates of expansion, are virtually the same as regards power and economy of fuel, if the comparison be not in favour of the single engine.

Having come to the conclusion that the same duty can be performed by the single as by the compound engine, and considering the important advantage of simplicity in mechanical construction, in opposition to complexity, however ingeniously contrived, it becomes a question how to obtain an effective, as well as a simple, process for the attainment of that object.

The first attempt was by revolving tappets, which had been long in use; these being formed and regulated in such a manner as to cut off the steam at such a point of the stroke as to give the exact quantity of expansion required. These tappets, to say the least, were from various reasons objectionable, as the weight of the vertical rods and the slowness of motion prevented them from producing the desired effect. The steam valves could, however, be fixed so as to cut off the steam at the required point of the piston passage in the cylinder, but the motion is not effected with the velocity essential to an efficient process of expansive action. Other processes have been tried for working steam engines expansively besides those already noticed; amongst them may be noticed the equilibrium valve, worked by double cams from the crank shaft. This method is generally used and adapted to the marine and old engines, but its application is seldom of much value unless the engines and boilers are capable of bearing a pressure of 15 lbs. to 20 lbs. on the square inch.

Another fault to which this description of valve is subject is their distance from the steam-ports in the cylinder, and the large quantity of steam which occupies the space between the cut-off valve and the working cylinder of the engine. To remedy these defects, and to apply a better system of expansion to the common condensing engines, the following apparatus and mode of working the valves was introduced:—

In giving a description of this effective and simple apparatus, it is but fair to state that the first idea of this invention was suggested by Robert Brownhill, at first imperfectly constructed, but since greatly modified and perfected by the author of the present paper.



The annexed drawing is a section of the side pipes, steam chests, and valves. It will be observed that the cylinder, the steam chests, and the side pipes F G, are common to every engine of this description; the internal construction of the steam chests, valves, and the mode of working, are peculiar, and constitute the chief merit of the invention.

In the construction of a steam engine, two important considerations present themselves—the attainment of a maximum of force, and the minimum in the consumption of fuel; to acquire the first, it is requisite to form such an arrangement of the working parts, as to obtain the closest approximation to a perfect vacuum under and above the piston, and the other is accomplished by having as small an expenditure of steam as possible. These desiderata are to a great degree attained by the principle upon which these valves are constructed, and the way in which they are worked. Referring to the figure, it will be seen that each of the steam chests, contains two double beat valves S T, also the shut-off valve R, and the throttle valve Q; these valves constitute the whole of the openings by which the steam is admitted and returned from the cylinder; the valves S next to the steam pipe E, are the valves by which the steam is admitted to the cylinder, and the valves T are the exhaust or the valves by which the steam escapes from the cylinder to the condenser. All the four valves are of the same area and dimensions, but the steam valves are not lifted up so high as the exhaust valves, for the reasons which are afterwards given. The directions of the arrows, exhibit the passage of the steam in its ingress to the cylinder, and its ultimate escape to the condenser. The double-beat valves of this construction have certain proportionate areas, the upper portion being larger than the bottom, in the ratio of 1.158 to 1.000. The object of this enlargement of the upper part of the valve being to give a preponderance to the pressure of the steam on the top side, in order to overcome the pressure of the packing in the stuffing-box which embraces the spindle, and to assist the gravitating force of the valve in its descent when liberated from the cam P.

The mode of working the valves is by the shafts and wheels marked upon the drawing I: they derive their motion from the crank shaft and revolve at the same speed. The vertical spindle I I, upon which the circular disc P is fixed, passes through the steam chest, and by its rotary motion the cams which are fixed upon the disc P, raise the valves as they pass under the rollers N N, which are connected to the valve spindles by the cross heads M M, and by these means the valves are raised and retained open or shut for any definite period. The rollers N N are steadied by the cross heads M M sliding upon the vertical guide-rods O O at their outer ends, and sliding at their inner ends in vertical grooves in the centre boss U, which is supported by the guide arms O O.

To work this engine economically much depends upon the pressure of the steam and the amount of expansion given to the valves. The usual practice is to work with steam at 15 lbs. on the square inch, and cut off at one-half the stroke, and expand the other half; but in other cases, when the engines and boilers are calculated to bear a high pressure of steam, say from 30 to 40 lbs. on the inch, the cams are formed so as to cut off the steam at $\frac{1}{3}$ or $\frac{1}{4}$ of the stroke. As is shown in the drawing at P, there are generally three and sometimes four cams upon each of the discs, so as to cut off the steam at one-half, one-third, or one-fourth, or at any other point corresponding with the force of the steam and the load respectively.

To obtain this range of expansion the rollers N N which work the steam valves are moveable, by brass strips which slide in the grooves in the cross heads M M, so as to bring the roller over any one of the cams that may be required; and the fixed pointer V shows, by a graduated scale on each brass slide, the exact point of the cylinder at which the steam is cut off, and by these means the extent of expansion is regulated and brought under the eye of the engineer.

It has already been stated that the steam-valves are not lifted so high as the exhaust-valves, and the reason of this is, that as the exhaust-valves are not variable in their action, and always require full opening into the condenser, it is desirable to retain them open throughout the whole length of the stroke. This process is effected with a greater degree of certainty than by any other description of valve; the exhaust valves are raised suddenly by the short inclined planes of the cams, and, having allowed time for the escape of the steam from the cylinder through a wide passage into the condenser, they suddenly fall by gravitation, and thus a more complete vacuum is formed under the piston than is probably attained by any other process.

The working of these valves is effected with a degree of certainty and

simplicity which renders them very satisfactory, both as regards their efficiency in conducing to the economy of steam, and the perfect ease with which they are worked.

The Chairman observed, that the principal part of the improvement described in the paper appeared to consist in the arrangement for effecting the expansion action by cams revolving horizontally.

Mr. W. Smith said, he had seen several engines working with this expansion gear, and could testify to the superiority of their action. The expansion gear was very simple, and worked exceedingly well; he had taken indicator diagrams from the engines. He was not acquainted with any cases where this plan had been at work for a long time, and he had some doubts as to the lasting of the parts.

Mr. M'Connell remarked, that was a matter on which they could scarcely express an opinion unless furnished with accurate data respecting the working. The Cornish engine reports were very complete as to the performance of the engines and the consumption of fuel; and if they had such information with reference to the working of the invention in question, it would be highly important as regards the improvement of the engine and its economical results.

Mr. Cowper suggested the desirability of making a collection of indicator diagrams in the Institution, and expressed his willingness to co-operate with other members in supplying some.

Mr. W. Smith said it was his intention, at an early meeting, to lay before the Institution several hundred indicator diagrams, which he had taken from engines in Staffordshire and the surrounding district.

Mr. McConnell observed, that the meetings of the Institution would afford parties connected with large manufacturing establishments an excellent opportunity for comparing the working results of engines in full action, not only in Staffordshire, but in Lancashire and other districts, and it was desirable that this class of information should be as perfect as possible.

Mr. Slate thought the diagrams referred to would read an important lesson to the parties employing steam engines, and induce them to look after their own interests and not waste their power. He had seen a number of Mr. Smith's indicator diagrams, and the results of them would surprise many; most of them showed a very inferior action, and some showed only 5lbs. per inch of vacuum with 13 lbs. per inch of steam, but there were a few good diagrams amongst them.

Mr. Gibbons remarked, that one important thing they would have to attend to was the description of fuel used, which varied so greatly in Staffordshire as to render it a matter of great difficulty to collect accurate data.

Mr. W. Smith thought it very desirable to know the description of fuel and the consumption, wherever it was practicable; but all that he proposed at present was to lay before the Institution diagrams exhibiting the economy of the engine, and not the consumption of fuel.

Mr. McConnell suggested that they should not confine themselves to the relative economy of the different constructions of engines, but they should also take into consideration the different constructions of boilers and the relative consumption of fuel for the power produced, as well as the kind of fuel employed. He saw no reason why the reports of engine performance should be confined to Cornwall, for it would be highly important to have them for the various other districts, more especially Staffordshire, Lancashire, and Newcastle.

Mr. Gibbons remarked, that this would be extremely difficult to obtain in Staffordshire, because the quality of fuel varied to an extraordinary extent. In that district they had a considerable boiler surface, and in many cases used only coal-slack for fuel, which was good for nothing else; but in Cornwall the quality of fuel was tolerably uniform, and the best qualities of coals were used.

Mr. Slate proposed to omit the consideration of the consumption of fuel, as the fuel was not bought in the coal districts, but merely taken from the heap as required, and it would not be practicable in most cases to obtain any accurate return of the consumption.

Mr. W. Smith said, the question of fuel could not be included in the iron districts, because it was customary in many cases to generate the steam by the waste heat of the puddling furnaces, and in consequence those cases would show no consumption of fuel; but, on the contrary, in other cases the consumption was greatly above the usual proportion, either from the inferior quality of fuel used, or from the engines being often worked much below their boiler power, and wasting from the boilers even more steam than was used.

The Chairman observed, that it took a great deal at first to induce the proprietor of a steam engine to look well after its working, but in Manchester considerable attention was now paid to the subject. There were many works where the consumption was as low as 4 lbs. per horse power per hour, but he should say that the average of Lancashire engines was twice that amount of consumption, if not more.

Mr. McConnell thought that was a strong argument for taking up the question in the broad view; for, without considering any particular district, it was very important for a manufacturer, or other proprietor of a steam engine, to know what his engine was doing, as compared with the engines of other parties. Those engines in the same town or district could be fairly compared, and any particular causes for exception could be stated in the return.

Mr. Slate observed, that there were a few pumping-engines in Staffordshire, which were worked by contract, and their fuel was all measured, so that the consumption could be correctly ascertained; but those engines were an exception in the district.

NINETEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Birmingham, Sep. 12.

(Continued from page 235).

"On Phosphorus as producing cold short Iron," by Mr. Rinman.—This was a statement of the discovery in the Swedish iron of phosphorus whenever it presented the peculiarity of being cold short, as it is technically termed. The process adopted was the following: The pig-iron, weighing about three grammes and reduced to small pieces, was dissolved in diluted nitric acid, the solution evaporated to dryness, the dry mass heated strongly with free access of air in order to destroy all carbon. After heating, the dry mass was triturated and mingled with six times its weight of soda, a little chlorate of potass and a little silica, and smelted as long as any gas was disengaged. The smelted mass was exhausted by boiling water, and digested for some hours. The solution was filtered, the undissolved residue washed with hot water, containing a small quantity of chloride of ammonium. The solution was evaporated to dryness, and the dry mass treated with hydrochloric acid and dissolved in water. After filtration, the solution was neutralized, and the phosphate of lime was precipitated in a closed vessel by a solution of chloride of calcium with ammonia. This method is published more extensively by T. Akerman, professor in Fahlun.

Dr. Percy spoke of the importance of this inquiry—particularly in such a district as Birmingham. He then instanced many of the peculiarities of the Staffordshire iron which contain phosphorus, and spoke of the peculiarity of the Berlin iron, which is so singularly fluid in casting as being probably due to some such combination.—Dr. Ronalds, Dr. Miller, and Mr. R. Phillips confirmed the fact of the general presence of phosphorus in cast iron.

"On the comparative Cost of making various Voltaic Arrangements," by Mr. W. S. Ward.—The author stated that a series of calculations founded on data, produced to the Chemical Section at Swansea, showed the efficient power of three generally used forms of battery known as Smee's, Daniell's, and Grove's, would be equal when 100 pairs of Smees,' 55 pairs of Daniell's, or 34 pair of Grove's were used, and that the expense of working such batteries as regards a standard of 60 grains of zinc in each cell per hour, would be about 6*d.*, 7½*d.* and 8*d.* respectively.

This communication led to conversations on the economy of the Electric Light and Electro-Magnetic Engines, in which Dr. Faraday, Mr. Shaw, Mr. Hunt, Mr. Elkington, and other gentlemen joined.—Dr. Faraday remarked on the imperfect character of the electric light, and its inapplicability for purposes of general illumination: all objects appearing dark when the eye was embarrassed by the intensity of the electric arc.—Mr. Shaw

and Dr. PERCY instanced the magneto-electric machines which are employed at Birmingham for electro-plating, in which the current cost of the motive power—viz., a steam-engine to put the magneto-electric machine in action was the only working cost.—Mr. ELKINGTON stated that they had never been induced to abandon the voltaic battery which they employed in their manufactory, finding it more economical than the magneto-electrical machine of which he was the patentee. He also stated the remarkable fact that a few drops of the sulphuret of carbon added to the cyanide of silver in the decomposing cell, had the property of precipitating the silver perfectly bright, instead of being granulated so dead as it is when thrown down from the solutions ordinarily employed.

SECTION D.—NATURAL HISTORY, INCLUDING PHYSIOLOGY.
President—MR. W. SPENCE.

The business was commenced by Professor DAUBENY, who read a report "On the Action of Carbonic Acid, on Plants allied to the fossil remains found in the coal formation." The apparatus used in these experiments was so constructed that a constant supply of carbonic acid could be kept up, so that plants or animals exposed in it were constantly subjected to the same quantities. The result of the experiments were, first, that quantities of carbonic acid, not exceeding five per cent., did not appear to affect injuriously species of ferns, or pelargonium; second, a quantity amounting to twenty per cent. injured plants exposed to it; third, the quantity of oxygen given out by plants was not found to be increased by the quantity of carbonic acid, to which they were exposed; fourth, on exposing animals to the action of carbonic acid, it was found that frogs and many fish could live in an atmosphere charged with five per cent. of carbonic acid. From these experiments he concluded that no objection could be offered to the theory of a large proportion of carbonic acid having existed in the atmosphere in the early periods of the world's history.

Mr. AUSTIN did not think the theory, broached by M. Brongniart, of the large quantity of carbonic acid in the early atmosphere of the earth tenable nor necessary to the explanation of the phenomenon of the great vegetation of the coal period. It was not even now well determined whether the principal part of that vegetation consisted of ferns. From his own experience in the growth of ferns, he had found that the soil in which they were placed greatly modified their growth. He did not think the temperature of Great Britain much changed since the coal period. Few of the ferns found in the coal possessed any fructification, whilst those in more southern beds presented it. This agreed with his own experiments, in which he found that the ferns of tropical climates would not fructify at a low temperature.

Professor MILNE EDWARDS said that the theory which explained the deposition of the mountain limestone by the chalk held in solution by carbonic acid was opposed to the fact that zoophytes generally soon died when the water in which they were kept was tainted with carbonic acid. He hoped Dr. Daubeny would extend his researches.

"Observations and Experiments on the Noctiluca Miliaris, the animalcular source of the phosphorescence of the British seas, together with a few general remarks on the phenomena of vital phosphorescence," by Dr. PRING. After reciting various observations by others on the phosphorescence of animals, the author detailed his own experiments at Weston-super-Mare, upon a small vesicular animal, not more than one-thousandth part of an inch in diameter, which possessed very remarkable luminous properties. This animal the author believed to be the *Noctiluca miliaris*. It occurred sometimes in so large quantities, and was so luminous, as to give the sea the appearance of a sheet of fire. After detailing its structure, the author gave the results of experiments upon the light emitted. Galvanism increased the luminosity; oxygen gas and carbonic acid gas also increased the light, but the latter most speedily killed the animal; sulphuretted hydrogen quickly destroyed the light; nitrogen, nitrous oxide, and hydrogen produced little or no effect on the luminosity; strong mineral acids increased for a moment but speedily afterwards destroyed the light; ether instantly destroyed the life of the animal; chloroform increased the light, and then destroyed the animal. The author then instituted a comparison between his own experiments and those of Professor Matteucci on the glow-worm; and after examining the various theories put forward to account for the luminosity of animals, concluded that the phenomena could not at present be referred to any more general fact with which we are acquainted.

Mr. R. TAYLOR referred to Ehrenberg's papers and to his opinion that the luminosity of animals depended on electricity.—Professor M. EDWARDS referred to facts which could not be explained either on the supposition of the cause being electricity, phosphorescence, or combustion.—Sir E. BELCHER related a number of facts with regard to the phosphorescence of the ocean, and expressed his conviction that it was not a living process.

A letter was read from Mrs. Whitby:—

Birmingham (Newlands).

"I had proposed offering to the British Association a short account of my progress in the art of cultivating silk in England; but I left Newlands before all the produce of this year could be wound off from the cocoon, and it will not, therefore, be in my power to make my report as full, or as as statistical, as I could desire. I am, however, unwilling that this meeting should pass, without endeavouring in some way to satisfy the expectations of those who have been sufficiently liberal to pay regard to my convictions, that the cultivation of silk may with little trouble or expense be made general, and in the end become a profitable speculation. From the period when I had the honour to place before you an account of my early trials, I have paid attention to the cultivation of the mulberry, especially of that species which I introduced in 1846, viz., the *Morus multicaulis* of the Philippine Islands. I have three other kinds of white mulberry, which all grow well at Newlands; but as none are so easily propagated as the *multicaulis*, or bear so great a weight of leaf, I have increased my plantation with them chiefly. I said, in my letter to the Royal Agricultural Society in 1844, that it was as easy to do so as to propagate the willow. I now say, that it is much easier, and the produce is more abundant. The produce of leaf this year has been immense, and even now, after having plucked them closely to feed my silkworms, they are strong and vigorous, and present a luxuriance of growth scarcely to be credited —unseen. I find the cuttings which are rooted in the open ground produce stronger and healthier plants than those struck under glass. One of my early pupils has a productive nursery at Godalming of the *Morus alba*—many others in different parts of England are planting; and if gentlemen in England and Ireland who have a few acres or roods of land to spare would plant mulberries for posterity as they do their oaks, we should, in a few years, be independent of other countries for our supply of raw silk. With regard to the rearing of the silkworm—as their habits become more practically known to me, I find less and less difficulty in bringing them to perfection; and am confirmed in my belief, that with due attention to their peculiarities they may be reared in England as easily as in any other country, and with as little loss by death. Equable warmth throughout the period of their existence (which may be shortened or prolonged at pleasure,) cleanliness, classification, and ventilation, with the adaption of the food (as to its maturity) to the different ages of the insect, will insure success. I have been this season very successful in rearing the worms I was able to hatch; they had no disease of any kind—they made their cocoon in thirty days, and the silk I have been able to wind off is as strong, and bright, and beautiful, as that which, in 1844 and 1845, was pronounced superior to the best Italian raw silk. There are many persons in England, and a few in Ireland, who have begun the experiment on a small scale. It requires time to mature and perfect any undertaking; but, if I live long enough, and the growth of the mulberry becomes generally encouraged, I have no doubt my ardent wish to see the cultivation of silk established in England will be realized. M. S. S. WHITBY."

SECTION G.—MECHANICAL SCIENCE.

President—MR. R. STEPHENSON, M.P.

"On a Method of supplying the Boilers of Steam Engines with Water," by Mr. W. S. WARD.—Mr. Ward's suggestion was to use a small supplementary pumping engine, having a working cylinder with valves so arranged that the piston may be put in motion by either steam or water

passing through it, to be supplied with steam, by a steam pipe, the entrance to which is somewhat narrow, and inserted in the boiler to be supplied, a little above the level at which it is desired to maintain the water therein. Such aperture should also be about the centre of a marine boiler. The working cylinder should be attached to a pump of such size as to be easily worked by the pressure of the steam. The exit pipe of the steam cylinder must communicate with the inlet pipe of the pump, so that if the cylinder be actuated by steam, the steam will be condensed, and its heat communicated to the water to be supplied to the boiler; or if the working cylinder be worked by water proceeding from the boiler, a considerable part of such hot water will be returned by the pump. The mode of operation of such apparatus will be, that whenever there is a working pressure of steam in the boiler, the apparatus will be in action; but if the level of the water be below the aperture of the small steam pipe, the action will be moderately rapid, and a supply of water be pumped into the boiler; and when the water in the boiler rises to the aperture, this being small, will be as though choked by the water, which will be forced through the working cylinder, moving the piston and pump very slowly; a portion of the water thus escaping from the boiler will be returned by the pump. Such last-mentioned action cannot continue long, inasmuch as the level of the water must be reduced; therefore the average level of the water in the boiler will be, with slight oscillations, maintained at the height of the supply pipe.

In the course of a brief discussion which followed, the President said that it was a new and ingenious idea, but one which he was afraid was not practically useful.

A 'Description of a Patent Tide-winding Apparatus' was read by Mr. R. Roberts.

A 'Description of the Eccentric Sheet-Metal and Wire Gauge,' was read by Mr. R. Roberts.

'On the Britannia Bridge.'—The President (Mr. R. Stephenson, M.P.) gave an interesting sketch of the causes which produced the late accident; and of the difficulties which have stood in the way of finally completing the work.

'On Chain Pipes for Sub-Aqueous Telegraphs,' by Mr. Whishaw.—Three links of a full-sized pipe for inclosing the wires of electric telegraphs in crossing rivers, &c., were laid before the Section. As the title implies, the pipe is formed by so many links connected together by sockets—each link varies according to circumstances from 18 inches to 24 inches in length, and from 1 inch to 2½ inches internal diameter, according to the number of wires to be inclosed. These pipes being of wrought iron, are exceedingly strong—and are required merely as a protection to the wires, which are previously insulated by means of gutta percha. Pipes of somewhat similar construction are laid under the Rhine and other rivers in Prussia—where the underground system of telegraphs is adopted by the Prussian Government (already to the extent of 1,200 miles)—although many of the railway companies suspend the wires between posts, as practised in England, America, France, &c.—The discussion which followed was brief; its purport was generally to signify approbation of the invention.

On the Superiority of Macadamized Roads for Streets of large Towns, by Mr. J. P. Smith.—There is a prevalent feeling against the employment of broken stone roads for streets, because, as they are usually managed, they are the cause of great inconvenience to householders and others by the dirt and dust they occasion, and also because their maintenance and repairs are very expensive, while the draught of vehicles upon them is very heavy. The object of this paper is to prove, from long continued experience on a large scale, that those objections do not necessarily accompany the use of such roads. In discussing this question the interests of two parties must be considered: those who principally use the roads, the owners and employers of horses and vehicles—and those who pay for it, the ratepayers, who are they who would be injured and annoyed if it were unduly expensive or unnecessarily dirty, dusty and noisy. It is a common error to consider that road the cheapest which costs the least in direct expenditure. If, however, this so-called cheapest road causes waste of horse power, undue wear and tear of horses and vehicles, loss of time by being unfit for rapid transit, and occasions loss to the inhabitants by filling their dwellings with dust and covering their clothes with dirt, it is evident that such a road is really very dear. There is an apparent diversity of interest between those who use and those who pay for our public streets; as the principal loss from bad roads falls directly upon those who keep or employ horses and vehicles, while the expense of road repairs falls upon the inhabitants generally. A little consideration, however, will show that this diversity of interest is more apparent then real. It is the interest of all that there should be easy, safe and cheap means of transit through the public streets; and any increase in the cost of transit is a source of indirect expense even to those who have no horses of their own, as it must add to the cost of everything carried through the streets, and of all hired vehicles and of all the numberless conveniences which accompany residence in a large town. It must also be remembered that it is very wasteful to allow a road to go out of repair, since it is less costly to keep a road up than to restore it. That roadway is best for the owner or user of a horse or vehicle which can be travelled over most easily, safely, quickly, and cheaply; and that ease, safety, speed, and economy are to be obtained by having the road firm, even, and smooth, and perfectly free from mud or dust, or any form of unattached materials. It is evident that the same qualities will render the roadway most free from noise, dirt, and dust, the three great causes of annoyance and injury to the inhabitants of all ordinary streets. The question which remains to be considered is, whether the advantages of good roads to the inhabitants generally are worth their cost? If the question had to be decided in accordance with the interest of the users and owners of horses merely, no doubt whatever would be entertained. Of whatever nature the surface of a road is to be, it is essential that its foundation should be of firm material, well consolidated, and perfectly drained; if not, the crust becomes loosened and destroyed, the road is rough and uneven, and wears into holes and ruts. Having obtained a good foundation, the next point is to cover it with a hard compact crust, impervious to water, and laid to a proper cross section. The stones must be broken to one regular size, well raked in, and fixed there by a binding composed of the grit collected in wet weather by the sweeping machines and preserved for this purpose. This binding must be laid on regularly, and watered until the new material is firmly set, which it will do very quickly, and with the regularity of a well laid pavement. The sharp angles of the stones are preserved, and there is both great saving of material and a firmer crust formed than by the common method of leaving the material to work into its place without the use of binding,—in which case the angles of the stones are worn off and reduced to powder, and at least one-third of the material is wasted in forming a binding in which the stones may be set. By the improved method the binding is formed of material that would otherwise be useless. Many road-makers object to the use of binding, on the ground that the road is rendered rotten by it, and that when the road is set it has to be carted away again. This is apt to be the case under bad management; and when ordinary soil is used, the fine particles of which work it into mud and keep the road from setting firmly. But the coarse grit obtained by the sweeping-machine off the roads is the very same material as is produced by wearing away the angles of the stones, and when judiciously applied to a new coating it will speedily become as well consolidated and firm as an old road. In the common method not only is there great waste of material, but the loose stones occasion delay by their resistance, great fatigue to the horses and danger to their feet, while the noise produced by their grinding together is annoying to the inhabitants. Upon the improved method the inconveniences of road repair are incomparably less than those of pavement. Both recoating and repairs may be made without stopping the traffic. Under no circumstances must any imperfection of surface be allowed. If a hollow be not immediately stopped it very quickly extends over the surface. All loose stones should be carefully picked, as every loose stone passed over by heavily laden carriages, if not ground to powder, breaks the crust of the road, and if water be permitted to lodge on the surface, it will cause great mischief. It is the neglect of these essential precautions that has lead many to consider macamadized roads expensive. They *are* expensive if neglected. On a well-made road heavy showers do good, by cleansing

them :—so, also, does artificial watering if the road be clean or swept quickly after it is watered. A road which is perfectly dry loses its tenacity and the surface grinds into dust; whence the economy of judicious watering in hot weather, which preserves the road as well as prevents the annoyance of dust. The practice so common in London and elsewhere of heavy watering a dirty road without cleansing it, and thereby converting the dust into mud, is very injurious to the road, and merely changes one nuisance into another, —dust into mud. A great source of waste, both to those who use and to those who repair a road, is to allow it to be dirty. The draught on a dirty road is twice as heavy as on a clean one,—that is, a horse must exert double force to draw his load with the same speed. The cost, however, of employing double force is so great, that the expedient of diminishing the speed is generally adopted, as a horse can exert greater pulling force at a slower pace,—less power being required to carry his own body. It often happens that the extra resistance occasioned by dirt diminishes the speed one-fifth or one-fourth. The effect of the dirt, therefore, is to increase the work by twenty or twenty-five per cent. It will easily be believed that such a waste far exceeds the cost of the most perfect cleansing. This is the case when cleansing is done by scrapers (the greatest enemy a macadamized road has to contend against.) By their use the stones are dragged from their places, and the adhesive dirt is not effectually taken away. Sweeping is the only mode of cleansing that should be allowed, either on streets or on turnpike roads. Sweeping by the wide brooms of Mr. Whitworth's machine is preferable to all other modes of cleansing yet tried. It must be evident, that the fact of these wide brooms sweeping longitudinally, with a pressure that can be adjusted according to circumstances, tends powerfully to preserve the road and to consolidate its surface. They press most upon the ridges, and least upon the hollows, thus tending to reduce the former, and fill up the latter. When the dirt is stiff, and adheres firmly to the stones, it should first be well watered, when it may be completely removed by the machine, without disturbing the crust, leaving the surface firm and compact. The use of water for this purpose has been objected to by high authorities, on the ground that it does remove the useful grit; but the contrary has been proved by ample experience. I have found that the use of the sweeping machines, with the proper employment of water, has reduced the amount of material required for the repair of roads in Birmingham one-third,—namely, from about 20,000 to 13,000 cubic yards. The first-named amount is the average for seven years preceding the introduction of the machines, —the latter of the three years subsequent. I communicated these details to a friend in London, and he determined to test their correctness. The following is the result of his experiment, to settle whether useful grit was or was not removed by water and machine sweeping. On the 22nd of March last, the Quadrant, Regent-street, was covered with a thick layer of dirt, which was causing great annoyance as well as injury to the road, but could not be removed by scraping, without removing also much of the new stone, to which it adhered. It was determined to sweep half of it dry, and half after proper watering. This was done, and the sweepings removed were washed, to separate the refuse from the stony matter mingled with it. One-third part of that which was taken dry, consisted of coarse grit, which would have been useful on the road—one-twelfth part only of that which was removed in the form of slop was stony matter; and that was so completely pulverised, as to be of scarcely any use; it had done its work. After the two portions of the road had been cleansed, the difference between them was very striking. That which was swept dry was still covered with adhesive matter, which was lifted by the wheels, together with the stones to which it adhered, the whole road being rough and uneven; the portion which had been swept with water was perfectly even and smooth. On the 24th both portions were swept, but only one-quarter as much dirt was taken from that which had been water-swept as from the other. On the 26th, it rained, and three times as much slop was taken off the part of the road which had not been water-swept on the 22nd. The preservative effect of water machine-sweeping was most evident by the decidedly better condition of that portion of the road cleansed in this effective manner. The great objection urged against macadamized roads for streets is the annoyance by dust and dirt which they occasion, and many persons prefer submitting to the deafening noise of pavement in order to avoid these; but this would not be the case if water and machine-cleansing was adopted, the cost of which would be saved in diminished wear and tear. The entire cost of cleansing and watering Birmingham is about 5,000*l.* per annum, or less than one penny per week for each of its inhabitants. It has been objected to macadamized roads that the draught upon them is heavier than upon pavement; and with carriages altogether similar this is the case, and especially so with vehicles travelling slowly. But it must be remembered that the proportion of the draught is only one of the circumstances by which the labour of the horse is to be estimated. Another very important consideration is the surface which gives the horse the safest footing; and his footing on pavement is so much less secure than upon a good broken stone road, that he does not receive the full advantage of the smaller draught. Again, carriages—especially those travelling quickly—are exposed to much more violent concussions upon pavement than upon a smooth macadamized road: consequently, not only must the carriages be stronger, and therefore heavier, but the increased frequency and violence of the concussions consume a larger portion of power, which goes far to counterbalance the diminished friction. There can be no doubt that the wear and tear of both horses and vehicles is far greater upon pavement than upon macadamized roads. In reckoning the real cost of a road, all expenses attending its use should be calculated; and if this were done, pavement would be perceived to be exceedingly expensive. Carriages roll so smoothly over a well maintained macadamized road, and horses are so little injured either by falls or strains, that I conceive the wear and tear upon them is not half of what it is on pavement.—*Athenæum.*

ROYAL CORNWALL POLYTECHNIC SOCIETY.

The seventeenth annual exhibition of this society was opened at the Polytechnic Hall, Falmouth, on 25th September, Sir Charles Lemon, Bart. M.P., president of the society, in the chair. The attendance and the articles exhibited in competition in the various branches of science and art, showed no falling off, we are happy to say, as compared with former years, although it might have been reasonably expected that the general sickness and depression of business would have produced an unfavourable effect. We regret that we can only afford room for abstracts of those papers, bearing more particularly on the mechanical arts.

An Essay on the Comparative Merits of Iron and Wood for Ship-building. By Edwin O. Tregelles, C.E.—The subject of building iron vessels is one that may well claim the attention of all who are interested in the prosperity of Great Britain. Success in this branch of our industry may be regarded as one of the means by which we may avert the consequences of the alterations in our navigation laws, dreaded by many as calamitous, and by which we may maintain that pre-eminence in the commercial world that has been so long enjoyed. It is probable that Great Britain cannot compete with many other portions of the globe in the construction of low-priced wooden vessels, and that, ere long, our shipwrights' yards will be merely places for repairing damaged vessels rather than for building new ones; whereas, if we bend our energies to the successful application of iron for the purposes of ship-building, it is probable that we should command the market in ship-building, and possess a commercial fleet of the highest order.

Let us assume that there are no prejudices to overcome, and no objections, real or imaginary, to be removed, and coolly consider the relative benefits that accrue from the employment of the respective materials. We will consider the advantages to the state of using the one or the other.

In the building of a first-class oak ship of 500 tons, we shall require about 700 of timber in the rough; that timber occupied 12 acres of land on an average 75 years, and is worth more than £1,200 as it stands growing before any labour of an artisan has been bestowed on it; or, in other words, £1,200 is the value of the raw material before it is manufactured, and the hull, when finished for launching, will be worth £6,000, the value of the raw material being one-fifth, or £1,200, and of labour and profits four-fifths, or £4,800. The value of the raw material for an iron ship of the same size would be about £50, being the royalty paid to the owner of the soil for the liberty to work the iron ore, limestone, and coal; the labour and profit would be nearly £6,000, say £5,950, and we shall then have an iron ship

costing £6,000, of which the raw material cost less than a half per cent. Some persons may estimate the value of iron and oak vessels at less or at more than the foregoing figures, which may not be the exact value of the respective classes, but they are sufficiently near the truth to exemplify the real facts.

We have, then, a vessel of 500 tons costing £6,000, whether of wood or iron, but the oak vessel would not last, on the average, more than 15 years, and would require to be repaired in that time probably five times, at an expense of say £300 each time, or a total of £1,500. This may be regarded as a very moderate computation, but it would increase the cost of the oak ship to £7,500, which, if sold for old timber, at the end would fetch £250, leaving £7,250 to be divided over 15 years, and we shall have £473 as the annual cost of the oak ship of 500 tons, exclusive of interest or capital. We will compare this with the iron vessel of the same size, costing £6,000, which, on the average, may be fairly estimated to last 20 years, and may require in that time to be repaired 10 times, at an expense of 100 each time, making the first cost and repairs £7,000. The value of the old iron ship at the end of 20 years may be estimated at £600, giving us £6,400 to be divided by 20 years, and we shall have £320 as the annual cost of an iron vessel of 500 tons, exclusive of interest or capital. Therefore we see that the cost to this country of using oak vessels may be expressed by the figure 473, and the cost of using iron vessels by the figure 320; or, if we allow for errors in the attempt to form an accurate approximation, we have still a great advantage in favour of iron if we place that figure at 3, and express the oak vessel by 4.

But an iron vessel of 500 tons register would carry 100 tons more than the oak vessel with the same displacement. Nor is this all; the speed of the iron vessel should be much greater, and it will run 6 miles whilst the oak goes 5½, or doing as much in 11 months as the oak does in 12, or earning £12 whilst the oak vessel earns £11. Again, in the time occupied in repairs, the iron ship would not be detained two weeks in the year on the average; whereas one month in each year must be allowed for the aggregate repairs of an oak ship, or 15 months out of the whole time, the money value of which is about £600, whilst the loss of time by the iron vessel would be only 40 weeks or 10 months, the loss of time being equal to £266. We have an advantage, then, of one-sixth as to stowage, and one-twelfth as to speed, making a saving of one-fourth on 30s., or reducing the cost of carrying by an iron vessel to 22s. 6d., (irrespective, of course, of the wages and victualling, which would be alike in each case), compared with 40s., the cost of carrying by an oak vessel. Besides this, we must estimate the saving in time for repairs, which we see is as £266 for iron, compared with £600 as the value of the time consumed in delay whilst repairing the oak vessel. Then if we can carry for 22s. 6d. what has heretofore cost us 40s., would not the adoption of iron vessels keep for us the advantageous position in commerce which we have long enjoyed?

But it may be argued that the premises are unsound, and therefore the conclusions are false; that an iron vessel cannot be as safe as an oak one, and therefore never can succeed; in fact, after all, "there is nothing like oak." Well, let us examine the subject in all the bearings within our reach, and perhaps we shall conclude that, after all, "there is nothing like iron!" We shall find some excellent practical remarks on the subject, in a work by John Grantham, a Liverpool ship-builder. He says—"What are the objects most desired by the merchant in the choice of a ship? These I consider are—

"1st. Strength combined with lightness.
"2nd. Great capacity for stowage.
"3rd. Safety.
"4th. Speed.
"5th. Durability.
"6th. Economy in repairs.
"7th. Cost.
"8th. Draught of water.

"I trust I shall be enabled to prove that iron vessels possess advantages under all these heads in so eminent a degree as to render them superior to wooden vessels, and address myself to each point in its respective order.

"First, *strength combined with lightness.* This subject involves two considerations, the strength of the materials, and the mode of uniting them. The great strength of malleable iron to resist strains in every direction is well known, but to those who are not conversant with the subject, the extent to which this advantage may be carried is not at first apparent, nor how the material may from comparatively small pieces be so combined in large masses as to form the ponderous body of a ship; and they are thus too apt to prescribe a limit to its use. An opinion indeed is now very generally entertained, that iron may be suitable for small craft, but is inadequate for the construction of vessels of heavy burthen; this, however, is a supposition so erroneous, that the reverse would be much more correct, for large vessels will afford the best practical demonstration of the superiority of iron for ship-building. In the application of timber, obstructions increase in a ratio proportioned to the increased size of the vessel to be built. How often has the ship-builder the greatest difficulty in obtaining timber to suit the varied curves of our finest ships? How often is the country despoiled of its noblest ornaments, by the tempting prices he is compelled to offer for its most magnificent oaks, the largest of which are frequently insufficient for his purpose! How are his brains racked, and his patience tried, in seeking for crooked timber necessary to frame a sharp floor, or a square bilge! How often is he obliged, though he knows it to be injurious, to scarf the frames for which no timber can be found sufficiently large to enable him to avoid such defects! And is not this one cause amongst others, why our building yards are empty, while our ports are filled with ships from other nations, in which timber is more plentiful, and the choice more extensive? But how stands the case when we turn to iron? Where is the frame even of the most intricate form, that our smiths cannot mould? Where the frame or beam so large, that iron cannot be found of which to fashion it, and that too, if need be, without a scarf? Here there are no knots, no sap, no cutting across the grain: here there is no useless timber, placed merely to fill in, or to cross buts. Here every inch of material is of service, and every scrap applied to some useful end. Iron has also, to a high degree, the power of resisting compression—timber, it is admitted, has great power to resist tension in the direction of the grain—but is very deficient in strength across the grain, and its power to resist compression is also very limited, especially when it is exposed to moisture. Again: timber after being some time in use, becomes brittle, and is but little disposed to bend. Good malleable iron, on the contrary, may be bent double even when cold, and does not become brittle with age, except when converted into an oxide. The ease also with which iron beams and frames can be wrought, and the facility of obtaining them of any dimensions in one piece, overcomes one of the greatest difficulties in shipbuilding. I have before stated that the power to increase the stiffness of the hull when built of iron, is unlimited; and, provided the shell has originally been made sufficiently thick, additional strength may at any time be given to the frame. The objections arising from the use of fastenings, of a material so totally different from that of which the hull is composed, are entirely removed in iron vessels. In the first place, the outer shell of the vessel is composed of a series of plates, so rivetted together that its strength is nearly equal to what it would be were it possible to form the whole of one plate. This shell is independent of all indirect means for preserving its completeness. It forms one grand whole of the same material throughout, and that of the strongest kind. This shell is stiffened as before described, by ribs crossing the joints of the plates at short distances apart, and giving an additional security. Beams, knees, bulkheads, all are brought together in one firm mass, and united by numberless, short, unyielding rivets. I may venture, indeed, to say that more real serviceable fastening is often employed in the space of a few inches in an iron vessel than is in most instances brought to bear on one entire beam of a timber-built ship." The *Royal George*, one of the iron steamers running between Liverpool and Glasgow—a vessel of unusual length in proportion to her beam—when loaded with about 150 tons of dead weight, besides her engines and coals, got on a rock, near Greenock, at high water, and was left there during a tide without sustaining any injury. She rested nearly on her centre, and all who saw her were of opinion that no timber vessel could have remained in that position without breaking her back. Captain Chaplin, who has had upwards of twenty years' experience in steam navigation, and who was for some time manager of Woodside Ferry, in the course of some remarks on the strength of iron vessels, says, 'I may give you a case in point. The *Cleveland*, built by you, got ashore amongst the rocks in an ebb tide, where she was left high and dry for seven hours, hanging entirely by the heel and forefoot, without sustaining injury either in the hull or engine.'

"*Stowage.*—The shell of a timber built vessel is so much thicker than

that of an iron vessel, that with the same outside dimensions, the latter is frequently 18 inches wider and 12 inches deeper in the hold than the former; taking the most favourable part of a vessel, namely, in the centre of the length in a vessel of 200 tons, the proportion in favour of the iron vessel will be as 5 to 6, but in the ends which are drawn finely off the disparity is much increased, making the proportion of the whole contents about as 5 to 4. Supposing, therefore, that a vessel built of timber could stow 200 tons she would if made of iron have room for 250 tons.

"*Safety.*—In addition however to their extraordinary strength, iron vessels afford protection both to life and property, against the most awful accident that can befal a ship at sea; namely, against fire. I admit that it can signify little to unfortunate passengers, of what material the hull of a vessel is made, if her cargo, deck, cabins, and masts are consumed; as no one who might escape the conflagration, could then remain in her. But with ordinary precautions, it would be nearly impossible for a fire to take place or to gain head in the hold of an iron ship, provided the hatches were properly secured.

"*Speed.*—The material being much lighter to attain the same strength and occupying less space, the model of the vessel may be made finer and better adapted for high speed, without a corresponding loss in the amount of stowage and carrying qualities; and iron vessels, as they have more buoyancy, are not so liable as timber-built vessels to pitch when in a heavy sea. These assertions are not the result of mere theoretical speculations, but are derived from a long course of observations, guided by the opinions of many practical men who have become converts to the adoption of iron, as a preferable material to wood, in the construction of vessels.

"*Durability.*—It is, as yet, impossible to assign any period for the duration of iron vessels in salt water, inasmuch as they have not been tried for a sufficient time to enable us to ascertain this point with precision; the want of this proof must, however, be considered favourable, from the fact that were their decay as rapid as that of wooden vessels, such a result would already have become manifest. The instance of the *Aaron Manby* will be in the recollection of many; she was launched in 1822, has been alternately employed in fresh and salt water, and is stated to be in good condition. The *Garryowen* has been about eight years in salt water, and is not yet perceptibly injured by decay; but the iron vessels of the Clyde probably furnish us with more decided proofs than any others of the durability of the material in salt water. It is well known that some of the first built of those vessels were extremely slight, yet it is truly surprising, when the frequent rubbing on the banks to which they are exposed is considered, how little effect time seems to produce upon them; so slight indeed is the apparent decay when the vessel is in use, and so much slower is its progress than is exhibited by iron when applied to other purposes in salt water, that many who have observed the fact, are led to suppose that some occult and preservative law is in operation, peculiar to iron so employed. A similar effect is said to be observable on the iron rails of a railway; the corrosion of which appears to be much less rapid when they are acted upon by carriages passing along them, than when they are lying in detached bars on the road side. We now turn to the consideration of the durability of timber-built ships—and where, I would ask, in the catalogue of objections, real or fancied, to iron ships, is there one to be found equal to that dreadful scourge to wooden vessels, the dry rot?—the effects of which are too well understood by ship-owners to require any lengthened remarks from me. I should not, however, do justice to my subject did I pass it over in silence. No age has been without its nostrums, its quackeries, and its infallible remedies for the dry rot, and no period has been so productive of them as that in which we live; but from all I can perceive, this plague is as prevalent as ever. How many stately vessels are now mouldering away under this destructive visitation, while their fine and graceful forms conceal the treacherous enemy within!

"*Repairs.*—The usual calculation for a timber-built steamer is, that the expense of repairs will, in ten or twelve years, have equalled the first cost. In a well-built iron steamer, repairs will not, I believe, have become necessary within that period, provided the vessel has not been injured by accidents; and, under any circumstances, I feel confident it will be more expensive to keep in repair the copper sheathing alone of a wooden vessel than to effect the whole repairs in the hull of an iron vessel.

"*Cost.*—No one, it may here also be remarked, can avoid observing and lamenting the low state in this country of what may be termed mercantile naval architecture, in which men of science meet with little or no encouragement to attempt improvements, and have become weary of a system which, for many years, has brought them no return. But let us hope for better things in iron ship building; let us trust that both owners and builders will see that their interest lies, the former in procuring good sound vessels, and the latter a price that will leave no excuse for imperfect work.

"From a careful consideration of the question of cost, I have arrived at the following conclusions:—

"1st. That a good serviceable iron sailing vessel, not exceeding 300 tons burthen, will be equal in cost to an English-built twelve years' timber ship of the same external dimensions, without including the price of copper sheathing for the latter.

"2nd. That iron vessels of about 300 tons, have the advantage of being rather less expensive than wooden vessels.

"3rd. That for very large merchant vessels, iron will also be found to be much less expensive than wood.

"4th. That iron sea-going steamers bear also about the same proportion, according to their different sizes.

"5th. That iron vessels for rivers may be built at a light expense, but so built are unfit for sea service.

"This estimate is to be considered to apply only generally, as the cost of either wood or iron vessels is ruled by the cost of the materials and the style of finishing.

"*Draft of Water.*—Iron sailing vessels may be built of any requisite depth and sharpness for holding on in a sea way; but where a light draft is essential for a peculiar service, it may be attained to a greater extent by the use of that metal than by timber. This advantage, of course, arises from the weight of iron necessary in the construction of a vessel, being much less than the weight of wood required for the same purpose."

In the foregoing remarks by John Grantham, allusion is made to bulk-heads, which are an important provision in case of leakage from striking on rocks or other causes. The bulk-heads are water-tight partitions, going completely across the hold of the ship, dividing it into four or five or more independent parts, so that if a leak occurs in one, the water only rises to a certain level in that division of the vessel without affecting the rest, and a vessel thus arranged may voyage a thousand miles in safety with a large leak, and without requiring pumping. We must not conceal from ourselves that a strong prejudice or alarm exists on account of the aberrations of the compass; but this difficulty is considered to be completely overcome by proper measures for correcting the errors. We are indebted to Professor Airy for this onward and important step in the march of improvement. We have quoted largely from the work on iron ship building; we might give much more with profit, but prefer recommending the work to the perusal of those who are impressed with the importance of the subject as a national question, on which John Grantham, at page sixty-eight, writes as follows:—"There could not be a better period than the present, when the foundations of every commercial system seemed to be shaken, and men are looking around in dismay at the depression that weighs down every branch of trade; there could not be a better period for considering with deep attention a question such as this, and endeavouring to draw from it some assistance towards alleviating the general distress. As a national subject, it will be found to possess more claims to our attention than are at first apparent."

These observations were written in 1842, and appear equally applicable in 1849. If this question be rightly considered, and fairly tried during the ensuing seven years, it will not be needful to write elaborate treatises to prove that for ship-building "there is nothing like iron!"

The application of iron to form a nest, or series of boats, may be very valuable for passenger ships. Six such boats might lie on the deck of a steamer, one under another, occupying only the space of one, by having the thwarts made to unship and be ready at hand to be brought into action in a minute during an emergency. Six boats, each weighing about half a ton, would carry 180 to 200 persons, and a system of this kind is exceedingly important for all passenger ships, whether steamers or others.

It cannot be denied that the accident which befel that magnificent ship the *Great Britain*, in Dundrum Bay, did much to check the progress of this improvement; but whilst it is admitted that this disaster checked the earnestness of our merchants to avail themselves of iron vessels, it may be

pointed out as a triumph in the achievements of science, that costly as was that ship in iron, it would have been vastly more so if it had been built of wood, and it is probable that if it had run ashore as did the iron ship, it would have gone to pieces in less than a week, instead of braving fearful storms for several months, and eventually floating off the beach, yielding to the judicious appliances of the talented engineer who had the charge of her construction. The few cases of failure in iron vessels are widely published, whilst some of the very remarkable instances of escape are scarcely recorded; in addition to the instances already quoted, may be mentioned the accident which befel the *Talbot*, a fine iron steamer that was built by the Neath Abbey Iron Co. to ply between Bristol and Port Talbot. One morning this vesssel was leaving Bristol river with a cargo, and being caught aground, was left by the tide supported by the head and stern, lying completely accross the river on her side, and was left so dry as for a boat to float under her; in this position she remained a whole tide until the water rose, when the engines resumed their duties, and conveyed her away uninjured to Port Talbot.

In considering the benefit obtained by using iron in preference to wood, we must not forget that the leakage of an iron vessel is scarcely appreciable; and if leaks occur, they are commonly very easily discovered and stopped, so that there is no bilge water—a consideration of great importance in carrying corn and other kinds of food.

It is true that there may yet exist strong prejudices to be overcome. So there were against steam vessels, as fraught with danger of many kinds—so there were also against the introduction of iron beams instead of wood for steam engines: there are engineers now living who remember this change, and the prejudices. How difficult it would be to avoid the snapping of the beam if the engine struck on the spring beams—how frightful would be the calamity of the cast iron beam of a pumping engine falling into the engine-house, or of the other end tumbling down the shaft of the mine! Many such prognostications were made, and some realised; but does any engineer, any sound mechanic, contemplate the idea of reverting to the wooden beam with its cast iron caps, and wrought iron straps? An excellent engine-beam, of enormous strength, might be made of wrought iron plates; but the attempt would be almost vain to form a frame-work of wood, however elaborate or well designed, that should be equal to the strength of the cast iron beams now used for the engines in Cornwall. If iron were not applicable for engine-beams, the engines of Cornwall must of necessity be much smaller in their dimensions and power—the deep mines could not be drained, nor their wealth developed; and so it may be said of iron for the use of vessels; without it we shall remain stationary, or retrogade, amongst nations in the march of commerce; but if we avail ourselves of the vast advantages placed within our reach, we may again become proverbial for intelligence and prosperity.

(To be continued.)

REPORT ON R. E. MONAGHAN'S APPARATUS FOR RECORDING THE AYES AND NAYS IN LEGISLATIVE ASSEMBLIES.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination, "A method of recording the Ayes and Nays in Legislative Assemblies," invented by Mr. R. E. Monaghan, of West Chester, Pennsylvania, report—

That the method of Mr. Monaghan consists in an arrangement of wires similar to that used in hanging our common house bells. Two such wires lead from the desk of each member to the desk of the clerk, where each one is attached to a lever, the free end of which carries a cutting edge or point.

Upon a suitable frame under the levers are placed lists of the members of the house, as many in number as it is desired to have copies of the record; and the levers are so arranged that the points of those attached to each desk are placed, the one before, the other after the name, and the columns in which the marks from these points come are headed, the one ayes, and the other nays.

The member votes by pulling either one or the other of the wires attached to his desk, which are labelled aye and nay, and by so doing he immediately records his vote as many times as there are lists of members placed under the points. The marks are very distinct, and the time occupied in the voting is reduced to that necessary for the clerk of the house to read the names and sum up the votes of the two columns.

It is not within the proper powers of this committee to decide upon any of the advantages to be derived from this method of rapidly taking the ayes and nays, except that arising from the great economy of time. The others, such as rendering the voting of members more independent, and preventing the resort to the calling of the ayes and nays, as a mere means of delay and vexation, being in their nature political. The committee, therefore, confine themselves to the expression of the opinion that the apparatus of Mr. Monaghan fulfils the purpose for which it was intended, by making any number of instantaneous records of the votes. Mr. Monaghan has submitted to the committee numerous certificates from the members and clerks of the House of Assembly at Harrisburg, where his apparatus has been erected, that its results were satisfactory.

The apparatus is very simple, not expensive, and easily repaired by an ordinary mechanic; and, so far as the committee know, they have reason to believe is novel. They, therefore, judge it worthy of approval.

By order of the Committee,

Philadelphia, July 12th, 1849. William Hamilton, Actuary.

PATENT LAW REFORM.

(Continued from p. 229).

SELECTIONS FROM EVIDENCE.

WILLIAM CARPMAEL, ESQ., Examined.

573. Will you describe what is the business of a patent agent?—A patent agent, strictly so called, would be the party to whom an inventor would come to take out his patent; and if he be well informed upon the subject of manufactures, he will be consulted to know whether the invention is new; and if he be practically informed upon most manufactures, he will be consulted also as to whether it is probable that the proposed invention will be usefnl; and the last head of his professional duty is that of preparing a specification on which the whole validity of the patent depends.

574. Is it not also part of his business to pass patents?—Yes, he passes them through the public offices.

575. Then it appears to be necessary that a patent agent should possess considerable scientific knowledge, and should also be acquainted with the practice of obtaining patents?—Yes, and also he ought to be well acquainted with all the decisions of law which govern patents, otherwise he cannot shape his specification to the requirements of the law.

576. The Committee understand that when an application is made to the Crown for the grant of a patent, the first step that is taken by the Secretary of State for the Home Department, is to refer the application to the Attorney or Solicitor General?—Yes, that is so.

577. The Committee have been informed also that a general caveat may be lodged with the Attorney or Solicitor General?—Yes.

585. Assuming that the report of the Attorney-General is favourable, the Queen's warrant issues from the Home Office to direct the Crown lawyers to prepare the Queen's Bill, does it not?—Yes.

586. At that point a second opposition may be made, may it not?—Yes; but it must be special against that particular patent.

587. Does opposition often take place at that stage?—There are no great number of oppositions at that stage. There are various causes that lead to it; but the opposing party in that case, must pay all the expenses.

588. Does it appear to you desirable that there should be two stages of opposition before the Attorney or Solicitor General!—I have seen the advantage of it in several cases. I have seen wrongs prevented by the opportunity being afforded for a second opposition.

589 Are there any advantages arising from their being special officers to receive objections made at that second stage; could not it be done by a mere clerk?—I should say not. It must be a man of experience, because he has to go through it just the same as at the original opposition, and very often to consider new facts. For instance, when you oppose upon the Bill, it is generally upon new facts: and very often the Attorney-General puts the parties to affidavits.

590. Bnt I mean for the mere reception of the opposition?—They receive them by their clerks.

591 No instructed officer is required for conducting that part of the business?—No. For instance, A. B. opposes; his opposition is received,

and notice is given, he having paid by anticipation a sufficient sum of money to cover all possible expenses of opposition.

592. Is there not a special officer appointed for the reception of that?—Yes; Mr. Poole, the clerk of the inventions holds the office. The parties have to pay over to him 30*l.*, and he accounts to the Attorney-General and to the parties after the opposition has been gone through. There is no necessity for a special officer there; the Attorney-General's clerk could do that. I have known the custom for 27 years, and I believe the present holder and his father have held that office for more than 50 years between them, and I never heard but what it was a special officer. It was very much inquired into at the time of the present Lord Lyndhurst being Attorney-General. I was then in a patent office myself, and I searched into it very closely, and I found in that branch of the Attorney-General's office (for it is a branch of the Attorney-General's office) that there was always a special officer for it.

593. To revert again to the question of the double stage before the Attorney-General, do you think it would not be possible to consolidate those two stages of opposition before the Attorney-General by making a different arrangement as to the length of the notice?—I think not. I think it would be prejudicial. There may be *one in fifty oppositions at the second stage, and it would be a pity to enlarge the time of notice to the injury to the other forty-nine.*

594. What is the general interval of time which elapses between the reception of the Report from the Attorney-General and the receipt of the warrant at the Patent Office?—Sometimes three days, sometimes less, sometimes a week, but, generally speaking, the queen signs very quickly.

595. The interval therefore is very short?—Very.

596. And therefore affords but little protection against the applicant?—*It has in a very large number of instances afforded great protection;* and I am not aware, practically speaking, that there is really any inconvenience suffered by an inventor beyond what is reasonble; a person will not go to the additional cost without some good reason. The advantages that I have known have been very large. Within my own knowledge a great wrong would have been done if some such opportunity had not been afforded.

597. Allowing that time, do you see any objection to the patent dating from the day of the first application?—Not the slightest, if you put other fences round, so that no wrong shall come of it.

626. Does it ever happen that the secret of an applicant for a patent is disclosed during its passage through the successive offices?—I have not known an instance in 27 years (?) I have heard a statement made of such a thing, but I never knew a man to suffer by reason of that (?)

627. What is your opinion with respect to the fees that are payable upon a patent at the successive stages? do you consider them desirable?—I think a patent should not be too low in cost. My own opinion is that in proportion to the number of patents granted the validity of any one is comparatively decreased by reason of the greater difficulty in making a specification.

628. The question with regard to the fees may be considered to resolve itself into two branches. First, as to the amount charged upon a patent, and secondly, as to the mode of paying that amount. Assuming that the same amount is charged, do you think it preferable to levy it in one sum, as for example, by a stamp duty, or to take it by successive fees?—I think it is perfectly immaterial.

629. Is not the present mode of payment troublesome to persons having to obtain patents?—Practically speaking, there is no trouble in it. It is immaterial how the money is paid.

630. On the other hand the payment of fees probably would supersede the necessity of some of the receiving officers now?—I can conceive that as regards the collecting of the revenue, I agree that that might be saved.

631. Assuming that a patent agent is employed by a party applying for a patent, the trouble of paying the fees is a very slight consideration?—It is very immaterial whether he pays it at once or in successive payments.

(To be Continued.)

ROYAL STEAM NAVY.

PROMOTIONS AND APPOINTMENTS.

We have great pleasure in noticing that Mr. Dinnen, Inspector of Machinery Afloat, has been appointed to the staff of the Steam Department at Somerset House, at a salary of £450 per annum.

Chief Engineers.—William Templeton, to the *Conflict.* Archibald Bain, to the *Virago.* William Richardson, to the *Spiteful.* Maurice Johnson, to the *Firebrand.* James Harvey, to the *Fisgard.*

Assistant Engineers.—Charles Moore, Isaac Cooper, and J. A. Belond, to the *Conflict.* Robert Drummond, Charles Cotton, William Wootton, to the *Spiteful.* James Morris, James Connor, and H. J. Wilkes, to the *Virago.* Samuel Stone, Richard Michael, Hugh Williams, and John Lee, to the *Firebrand.*

DOCKYARD INTELLIGENCE, &c.

"Archer," screw-sloop, went down the river on an experimental trial on the 15th September. She is of 973 tons burden, and fitted with the engines of 200 horse-power taken out of the *Rifleman*, of only 484 tons. The diameter of the screw used in the *Rifleman* was 8 feet, with a pitch of 8 feet, and in that ship the engines made 46 and 48 revolutions per minute, but the greatest number they made in the *Archer*, with a screw of 12 feet 6 inches, was 23.3 per minute, on the 15th September, and when the vessel was tried again, after having 12 inches taken off the diameter of the screw, it was 23.25 revolutions per minute. The average speed attained by the *Archer* in three runs, twice down and once up, the measured mile, in Long Reach, was 6.391 knots per hour, and the average of six runs on the 15th September, was 6.151 knots per hour, the vessel drawing 13 feet 8 inches forward, and 14 feet 10 inches aft. At a further trial on the 28th, with the diameter of the screw reduced to 10 feet, a speed of seven knots was attained. On the 11th inst. she was again tried, with the screw reduced to 9 feet. The engines made 37 revolutions, and the speed was increased to 7.9 knots per hour.

The *Terrible* has had two of her boilers taken out, the vacant space to be converted into coal bunkers.

The Arctic Expedition.—Great interest has been excited by the reported news of Sir J. Franklin and his companions. We sincerely hope that the intelligence may be true, but we must confess that the objection which we have heard made to the veracity of the Esquimaux's statement, appears to us of very great weight; that is, if these men were on board the vessels, as they state, why did not the officers of the expedition make some use of the channel of communication thus offered to them? Whilst on this subject we may mention a proposition which has been made to Sir F. Baring, Esq., by Mr. G. Shepherd, C.E., to undertake the breaking up of the ice by exploding shells, or cases of gunpowder, underneath it. From experiments which he witnessed in 1844, on the Danube, on ice four feet thick, Mr Shepherd anticipates that from 10 to 15 miles per day could be effected with ease. By this means a passage might be opened to relieve the vessels *when* they are found.

STEAM NAVIGATION, SHIP BUILDING, &C.

The "Prussian Eagle" War Steamer.—We had an opportunity a few days since of inspecting this vessel, which has been lately docked at Messrs. Wigrams' yard, to have her bottom cleaned. She is of 850 tons burden, and was built about two and-a-half years ago by Mr. Ditchburn, at Blackwall. The engines are on the oscillating principle, of 300 horse power, by Messrs. Penn. Some interest is attached to her, as she has been in action with a Danish vessel, and received two shots in the hull. One struck her abaft the paddle-box, in the wale piece, about half-an-inch thick, and passing through, buried itself in the coals, leaving a *clean circular hole,* which could easily have been stopped, had it been so near the water line, as to render it necessary. The second shot struck her forward and glanced off, after splintering the plate, and forcing a small portion of it through the wood lining into the cabin. Neither the rivets nor the plates were at all started in the neighbourhood of the holes, as some of our naval authorities seem to take it for granted, will always be the case in iron vessels. The shots, however, it must be observed, were only 18-pounders. She has been in constant service since she was built, and has cost nothing in repairs during that time, which reflects great credit both upon the contractors and the officers in charge of her.

The German States' War Steamer, "Cora."—The *Cora* is one of the steamers built by Messrs. Patterson and Co., of Bristol, for the Government of the German States, with oscillating engines, by Messrs. Miller, Ravenhill and Co. She is 185 ft. long, 34 ft. 3 inches beam, and 17 feet depth of hold, burden 970 tons, engines, 270 horse nominal power, cylinders, 63 inches diameter × 4 ft. 6 inches stroke. Paddle-wheels, 19 feet diameter, tubular boilers. She is remarkably well-built, with knees to every beam, and diagonal timbers, and her engine power being small, she carries a great spread of canvas. The trial trip took place on the 27th inst., when her speed was 10½ knots against wind and tide; the engines making 25 revolutions per minute. She answered her helm well, having been brought round in less than three minutes. The anchor, with 50 fathoms of chain, was hove and stopped in six minutes, by Brown's Patent Capstan. The *Cora* has been built and fittted for sea in less than six months from the date of order. She is to be commanded by Captain Reichstadt.

The Portuguese War Steamer, "Mindello."—This vessel has been docked at Mr. Green's yard, to undergo extensive repairs in her boilers, by Messrs. Blyth, the original contractors for the vessel and her engines.

New Line of Steamers to the United States.—A Liverpool Company has proposed to establish a line of steamers between that port and Charlestown, U.S., which has created much interest amongst the merchants and others of South Carolina.

Ship-building in New York.—The following interesting returns of the ship building trade of New York are given:—From 1st January to September last, the amount of tonnage launched had been 20,257; for the whole year ending December, 1848, 36,649, against 39,718 tons in 1847. Tonnage on the stocks in September, 1847, 29,870, against 15,710 in 1848, and 28,960 in September, 1849. The number of vessels launched this year has been 53, of the value of 3,300,000 dollars.

The New American Atlantic Steam-ships.—Within a year five of the largest steam-ships in the world will be sent to sea. The two in the state of great forwardness are the *Ohio* and *Georgia*, belonging to the New Orleans and Chagres mail line. These ships are shaped upon the most beautiful model yet adopted in the construction of any steam-ship. Their capacity is stated to be 2,750 tons each Larger than these are the two ships building under the contract for the conveyance of the mail between New York and Liverpool, held by Mr. E. K. Collins, *Atlantic* and the *Pacific*, which are now receiving their engines at the works of Stilman and Allen, and Allaire and Co. These ships are rated at over 3,000 tons each, and will be capable, in the opinion of their constructor, of carrying a greater number of passengers and more freight than any steam-ship ever built, not excepting the *President* and *Great Britain*. Another very large ship, that can soon be fitted for sea service, is the *Franklin*, of 2,200 tons. Her model is a very fine one, and appears adapted for the attainment of great speed. She was commenced by the proprietors of the Bremen line, but is said to have been transferred to Messrs. Fox and Livingston, who design placing her upon the route to Havre, *viâ* Southampton. Besides these, four other steamers of the largest class are under contract, and will be built as soon as practicable. Two of them will belong to Collin's line, and will be of the same tonnage as the *Atlantic* and *Pacific*. One of them, the *Arctic*, is nearly ready for launching. Here, therefore, is to be a fleet of nine steamers, which, for size and costliness, will exceed any yet brought into service on this or the other side of the ocean.—*New York Post.*

New Mail Contract.—Tenders for a contract to convey mails to and from Australia and New Zealand, are expected to be advertised for by the Government in a few days. New Zealand will be included in the contract, to enable parties to tender for the conveyance of the mails *viâ* Panama and the Pacific, as well as by way of Egypt and India.

Port and Harbour of Chester.—An enquiry has taken place by two Admiralty Commissioners to ascertain how far the River Dee Company have carried out their engagement to maintain 15 feet depth at high water. It is contended by its opponents, that the company had embanked large estates from the estuary of the Dee, at the sacrifice of the navigation. The meetings were numerously and respectably attended, and among those present were Sir A. Dalrymple, Mr. Rankin, and Mr. W. A. Provis, C.E., on the part of the company. Mr. Henry Robertson, C.E., and Mr. Robert Roy, secretary, and Mr. Martin, Parliamentary agent, respecting the Shrewsbury Railway Company; and Mr. T. L. Marriott, and Mr. Hamilton Fulton, C.E., on the part of Shipping and Manufacturing interests. The report of the Admiralty is looked for with much interest by all parties concerned.

Currents in the Mediterranean.—We learn from the *Athenæum*, that, from investigations undertaken by M. Coupvent-des-Bois, he has ascertained the existence of a superficial current flowing into the Mediterranean, and of a deep under current flowing out of the Mediterranean, and that between these two currents there exists a bed of water in a state of rest.

THE "INFLEXIBLE" STEAM-SLOOP.

BY CAPTAIN HOSEASON.

The *Inflexible* is one of the vessels of the latter day design of Captain Sir William Symonds, was launched at Pembroke in 1846, is of 1,122 tons, 375 horse power, direct action engines by Fawcett, with an 8-lb. load upon the valve. The distance run by her, not including going in or out of harbour, from the 9th of August, 1846, to the 28th of September, 1849, when she was paid off, was as follows:—

Steamed	64,477	nautical miles.
Sailed	4,392	„ „
Total distance ...	68,869	„ „

Number of days under steam	345½
Ditto under sail	27¼
	372¾
	Knots.
Average daily steaming	186.62
Average daily sailing	161.18
For the whole period	57.44
	Hours.
Time under one boiler	76¾
Ditto two boilers	4,047
Ditto three boilers	3,324¼
Ditto four boilers	844
Total	8,292
	Knots.
Rate of steaming per hour	7.775
Rate of sailing per hour	6.715

Her fires have been alight 483 days 9¾ hours.

Total consumption of coals while under steam, 8,121 tons 12¾ cwt. Coals for raising steam and banking fires, 576 tons 16¾ cwt. Average distance steamed per ton of coals, 7.938 knots. Consumption of coals per hour, 19,583 cwt.; ditto per day, 23 tons 10 cwt. 12½lb.

The above mentioned distances are obtained by the patent log towed abou 50 fathoms astern, out of the influence of the back-water caused by the revolutions of the paddle wheels, and not from the common or hand log, or from the distance accomplished in a run from A to B, or port to port, when making a voyage, for the error caused by throwing the common or hand log into the "back water" created by the revolutions of the wheels, has been proved by the *Inflexible* to vary from one even to four knots an hour, the common log and revolutions give 11 knots, while the patent log and bearings of the land gave only seven knots.

The expenditure of coal has been obtained by the positive measurement of every tenth bag in the ship, and every tenth as used by the fires, and a mean taken every four hours as the hourly expenditure.

The distance stated to have been accomplished by the *Inflexible* has been deduced on the main from the time the patent log has been put overboard, when the final departure from the land has been taken; therefore she must have run many hundreds of miles more than is recorded in these returns.

This abstract, being from the voyages during the entire commission, includes the performances on the stormy coast of New Zealand, where she

was constantly employed running for 15 months, burning the Newcastle Australian coal, the best quality of which is about 10 per cent. inferior (even when delivered at the mines) to good English coal; but from having been exposed on the open beach at New Zealand it was rendered fully 25 per cent. inferior to the average Welch coal. About 4,000 tons in the estimate stated above are of that inferior quality, and must, therefore, be kept in view, when the economy of the expenditure is considered. Another important feature in the mode of ascertaining the true expenditure of this ship must be here explained—the hourly and daily expenditure always contains a certain amount allowed for wastage, so that the true quantity remaining in the ship is known after the daily expenditure is ascertained.

The quantity to be allowed for wastage was obtained in the following manner:—On the outward voyage of the *Inflexible* to the Cape of Good Hope, in August and September, 1846, when a run of 5,502 miles was accomplished on a single coaling, at a mean average velocity of 7.31 knots per hour, and at an expenditure of 12 tons 19 cwt. 3 quarters 14lb., 8lb. in every 252lb. were allowed for wastage, equal to 3.174 per cent.; but a deficiency of 7 tons of coals in the whole quantity received in England was found to be the result of this allowance, proving the actual wastage to be equal to 4.955 per cent., with coals of an average quality.

On the voyage from the Cape of Good Hope to Port Jackson, Sydney, when again 5,356 nautical miles was accomplished on one coaling, at an expenditure of 458 tons 10 cwt., or at the rate of 15 tons 3 cwt. 2 quarters per day, and at a mean average velocity of 7.87 knots per hour, 20lb. in every 252lb. were allowed—equal to 8 per cent., but on a survey of the remainder at the end of the voyage, 12 tons were found remaining as surplus; this would be equal to 2.69 per cent. allowed more than was required by wastage and decrease of density, thus proving the actual wastage during the voyage as equal to 5.31 per cent. 5 per cent. was afterwards estimated and fixed up as correct, and must therefore be substracted from the gross quantity, if the true duty, in miles, per ton of coals, is sought by any parties who may investigate the above data.

A remarkable instance of the exercise of the full power of the engines occurred when the *Inflexible* towed the barque *Claudine*, and succeeded in transporting 1,500 soldiers, tent equipage, and baggage 1,400 nautical miles in 12 days, four of which were employed in the landing of one regiment and the embarkation of another. It was highly important that the run from Madras to the Arracan coast should be performed in the least possible time, as the N.E. monsoon, which would have been dead a-head, was hourly expected, therefore the four boilers were put into requisition; the *Inflexible* carefully kept at a favourable line of immersion to develop speed, for when a vessel is to be towed for a moderate distance, care must be ever taken not to have the towing vessel too deep.

This forms a mere abstract from more voluminous data of a minute nature, extending over a period of more than three years, compiled with the single object of eliciting the truth.—*Times.*

NOVELTIES.

EXHIBITION OF THE INDUSTRY OF ALL NATIONS.

The meeting at the Mansion House, on the 17th instant, to receive a deputation from the Society of Arts, to explain the proposal of H. R. H. Prince Albert for a great exhibition of the industry of all nations, to be held in London in the year 1851, has been so universally commented on by the daily press as to leave us but little to say on even this unusually suggestive subject. If we had space, we should be glad to place on record the speech of Mr. H. Cole, who graphically described the warm reception the deputation had met with in the provinces. We need but say here that the proposed subjects of exhibition are fourfold—raw materials, machinery, manufactures, sculpture, and plastic arts in general. The prizes are to be one money prize of £2,000; four of £1,000; and medals which, it is possible, may be conferred by the Queen. London has seen many brilliant epochs, but we doubt not this will surpass all. In fact, our only fear is that the size and extent of the exhibition will interfere with its usefulness.

Mr. Fairbairn, C. E., has been invited by the Prussian Government to offer his advice and assistance in connection with an important work about to be undertaken in Rhenish Prussia, It has been determined that the Rhine shall be no longer a barrier to an uninterrupted railway communication between the shores of the German Ocean and the great cities of central Germany; and the neighbourhood of Cologne has been selected as the fittest site for effecting this junction. Chevalier Bunsen, while in Manchester lately, became deeply interested in the system of bridge building which Mr. Fairbairn has carried out by the employment of wrought-iron as a material for the construction of great girders; and expressed his conviction that this system was, perhaps, the only one calculated to meet the requirements of his government and the corporate authorities of Cologne. Mr. Fairbairn has been called to Berlin to submit his design to the King of Prussia and the local authorities. It has been hitherto been considered an impossibility to erect permanent structures able to withstand the enormous masses of ice brought down from the Alps.

Purification of Water.—It is now generally acknowledged that not the least amongst sanitary arrangements stands the supply of good water; but up to the present time, little or nothing has been done to ensure that good or pure water only shall be imbibed by the inhabitants of our cities and towns. It is true that such things as filters exist, but these are, in nine cases out of ten, little better than a delusion, as they will only effect the *mechanical* process of *straining* off the solid impurities contained in the liquid, leaving untouched the impurities with which the water is *chemically* impregnated, and which can only be removed by *chemical* means. It is known that all water, except distilled water, is more or less charged with various adventitious earthy, saline, and gaseous matter acquired by transit through the soil, &c. As regards the grosser impurities subsidence generally removes them, but the calcareous and earthy compounds still remain, which have to be got rid of before the water is rendered fit for drinking. Mr. Horsley, chemist, of Ryde, in the Isle of Wight, has recently patented a plan for purifying water, which his specification, just enrolled, states, is based on the application and extension of the use of such chemical materials as have been hitherto used to test the presence or absence of the impurities of water by forming insoluble precipitates, and this he extends and applies to the purification and separation of such earthy and saline adventitious matter from the water in which the same is contained, such purification and separation to be conducted upon the principle of either single or double elective chemical affinity, commonly known to chemists; or in other words, by a system of displacement based on the nature and theory of chemical equivalents, or the knowledge of the parts and proportions in which these several substances unite and become held in solution.

Improved Tracing-Paper.—We have tried a new description of tracing-paper supplied to us by Messrs. Waterlow, which bears shading on with colour and takes a fine line, better than any other paper we have ever met with. Draughtsmen who are in the habit of making fine coloured tracings will duly appreciate these rare qualities, which are attained without any sacrifice of the transparency.

A Workman's Hall.—At Messrs. Ransome and May's establishment the site of a Workman's Hall has been determined upon, and the money is now ready to build it. It will cost about £1,000. There will be forty dormitories for single men and lads, which will be let at about 1s. 6d. a week, including attendance; there will be a large room for evening resort, a workman's drawing room, a library and reading rooms. The building will be fitted up with baths. There will be a resident matron and mistress; a kitchen, and a cook. The privileges of the hall will be available to every workman upon the establishment upon paying a subscription of one shilling a quarter; and each member will thus not only have a cheerful room to spend his evenings in, but the opportunity of obtaining his early breakfast, his dinner, and his cup of tea, at a cheap rate. The benefits arising from an institution of this kind are manifest. The young unmarried men at the factory, are those over whom the employer should watch with the tenderest interest. The first entrance into independent life, the emancipation of the child from parental control, is the most critical moment perhaps of a workman's career. He may become the able, experienced, respectable foreman; or if he falls into idle, dissipated habits, will first render himself unfit for work, and sink eventually into beggary or crime. His situation, too, is full of danger. His wages are not sufficient to allow him to marry; they are often more than sufficient to satisfy the most urgent wants of life. He lodges, perhaps, at the public house; at any rate he gets his meals there, and, at other times, the society which is to be met with in the taproom attracts him thither. These evils are prevented by a Workman's Hall. There the young man will find some of the comforts of a home; and he will no longer be forced into too early, and therefore, an improvident marriage, in order to escape from the discomfort attending a solitary existence.—*The Responsibilities of Employers.*

AMERICAN SCRAPS.

"The proprietor of one of the large quarries of gypsum, on the Shubenacadie, showed me some wooden stakes, dug up a few days before by one of his labourers from a considerable depth in a peat bog. His men were persuaded that they were artificially cut by a tool, and were the relics of aboriginal Indians; but, having been a trapper of beavers in his younger days, he knew well that they owed their shape to the teeth of these creatures. We meet with the skulls and bones of beavers in the fens of Cambridgeshire, and elsewhere in England. May not some of the old tales of artificially cut wood occurring at great depths in peat and morasses, which have puzzled many a learned antiquary, admit of the like explanation?"

"I heard frequent discussions on the present state of the timber duties, both here (Nova Scotia) and in Canada, and great was my surprise to find the majority of the small proprietors, or that class in whose prosperity and success the strength of a new colony consists, regretting that the mother country had legislated so much in their favour. They said that a few large capitalists and shipowners amassed considerable fortunes (some of them, however, losing them again by over-speculation), and that the political influence of a few such merchants was naturally greater than that of a host of small farmers, who could never so effectually plead their cause to the Government. But, on the other hand, the labourers engaged during the severe winter, at high pay, to fell and transport the timber to the coast, became invariably a drunken and improvident set. Another serious mischief accrued to the colony from this traffic: as often as the new settlers reached the tracts from which the wood had been removed, they found, instead of a cleared region, ready for cultivation, a dense copsewood, or vigorous undergrowth of young trees, far more expensive to deal with than the original forest, and, what was worse, all the best kinds of timber, fit for farm-buildings and other uses, had been taken away, having been carefully selected for exportation to Great Britain. So that, while the English are submitting to pay an enhanced price for timber, inferior in quality to that of Norway, the majority of the colonists, for whom the sacrifices are made, feel no gratitude for the boon. On the contrary, they complain of a monopoly that enriches a few timber merchants, at the expense of the more regular and steady progress of agriculture."—*Lyell's Travels in North America.*

LIST OF ENGLISH PATENTS,

FROM SEPTEMBER 13, 1849, TO OCTOBER 18, 1849, INCLUSIVE.

Richard Archibald Brooman, of Fleet-street, patent agent, for certain improvements in draught-horse saddlery, harness, and saddle-trees. Patent dated September 13. Six months—Communication.

David Stephens Brown, of the Old Kent Road, gentleman, for certain improvements in apparatus or instruments for the fumigation of plants. Patent dated September 13. Six months.

Henry Attwood, of Goodman's Fields, in the county of Middlesex, engineer; and John Renton, of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch and other like articles of commerce, from farinaceous and leguminous substances. Patent dated September 13. Six months.

Edme Augustin Chameroy, of Rue du Faubourg St. Martin, in the city of Paris, for a new system of railway (denominated Helicoide), heliacal railway, and a circular chariot. Patent dated September 13. Six months.

Napoleon Pierre Preterre, of Havre, in France, for improvements in the construction of coffee and tea-pots, and in apparatus for cooking; also in apparatus for grinding and roasting coffee. Patent dated September 13 Six months.

Edwin Heywood, of Glosburn, in the county of York, designer, for improvements in plain and ornamental weaving. Patent dated September 13. Six months.

Robert Griffiths, of Havre, engineer, for improvements in steam engines, and in propelling vessels. Patent dated September 13. Six months.

Thomas Marsden, of Salford, in the county of Lancaster, machine-maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances. Patent dated September 13. Six months.

Benjamin Goodfellow, of Hyde, in the county of Chester, engineer, for certain improvements in steam engines. Patent dated September 13. Six months.

James Potter, of Manchester, mechanist, for certain improvements in spinning and doubling machinery. Patent dated September 13. Six months.

Charles Marsden, of Kingsland road, for improvements in traps to be applied to closets, drains, sewers, and cesspools. Patent dated September 20. Six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in pumps, and in machinery and apparatus for working the same, which latter improvements are also applicable for working other machinery. Patent dated September 20. Six months.—(Communication.)

William Handley, of Chiswell-street, Finsbury, confectioner; George Duncan, of Battersea, engineer; and Alexander McGlashan, of Long Acre, engineer, for improvements in the construction of railway breaks. Patent dated September 20. Six months.

Henry Bessemer, of Baxter House, Old St. Pancras road, engineer, for improvements in the preparation of fue, and in apparatus for supplying the same to furnaces. Patent dated September 20. Six months.

Elijah Galloway, of Southampton buildings, Chancery-lane, engineer, for improvements in furnaces. Patent dated September 20. Six months.

Joseph Rocke Cooper, of Birmingham, gun and pistol maker, for improvements in fire arms. Patent dated September 20. Six months.

Edward Staite, of Lombard-street, gentleman, and William Petrie, of King-street, gentleman, for improvements in electric and galvanic instruments and apparatus, and in their application to lighting and to motive purposes. Patent dated September 20 Six months.

William Pearce of Haigh, near Wigan, Lancaster, and Edward Evans, of Wigan, engineers, for improvements in steam engines and in pumps. Patent dated September 20. Six months.

Josiah Lorkin, of Ivy-lane, merchant, for an improved instrument or apparatus for beating or triturating viscous or gelatinous substances. Patent dated September 20. Six months.

Benjamin Wren, of Yarm, in the county of York, miller, for an improvement in cleaning and treating certain descriptions of wheat. Patent dated September 20. Six months.

David Owen Edwards, of Sydney-place, Brompton, surgeon, for improvements in the application of gas for producing and radiating heat. Pated dated September 20. Six months.

John Baptiste Vuldy, of Mile end, dyer, for improvements in giving a gloss to dyed silk, in skeins or hanks. Patent dated September 20. Six months.

Thomas Griffiths, of Islington-row, Birmingham, for improvements in the manufacture of tea and other pots and vessels and other articles made of stamped metal. Patent dated September 20. Six months.

James Higgins, at Salford, in the county of Lancaster, machine maker, and Thomas Schofield Whitworth, of Salford, aforesaid, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Patent dated September 24. Six months.

N.B. This patent being opposed by caveat at the Great Seal, was not sealed till the 2nd of October, but bears date the 24th of September, the day it would have been sealed if not opposed.

John Meadows, of Princess-street Coventry-street, in the county of Middlesex, carver and gilder, for improvements in veneering. Patent dated September 27. Six months.

John Marriott Blashfield, of Millwall, Poplar, in the county of Middlesex, roman cement manufacturer, for improvements in the manufacture of manure. Patent dated September 27. Six months.

William Browne, of St. Austell, in the county of Cornwall, mine agent, and Richard Rowe Veale, of St. Columb Major, in the said county, gentleman, for improvements in preparing for pulverization flint stone, china stone, ores, minerals, spas, sands, earths, and other substances. Patent dated September 27. Six months.

Nicholas Doran Maillard, of Edward-street, Portland-street, engineer, for improvements in obtaining motive power for giving motion to machinery, and in propelling vessels. Patent dated September 27. Six months.

William Boggett, of St. Martin's-lane, in the county of Middlesex, gentleman, for improvements in heating and evaporating fluids. Patent dated September 27. Six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the manufacture of knobs for doors, articles of furniture, or other purposes, and in connecting metallic attachments to articles made of glass or other analogous materials. Patent dated September 27. Six months.—(Communication.)

William Jamieson, of Ashton-under-Lyne, in the county of Lancaster, machine maker, for certain improvements in looms for weaving. Patent dated October 4. Six months.

Charles Attwood, of Tow-law iron works, near Darlington, in the county of Durham, Esq. for an improvement or improvements in the manufacture of iron. Patent dated October 5. Six months.—(Communication.)

William Edward Newton, of Chancery-lane, for improvements in machinery for planing, tonguing, and grooving boards or planks. Patent dated October 5. Six months.

Alfred Vincent Newton, of Chancery-lane, for improvements in the manufacture of pipes or tubes. Patent dated October 5. Six months.

Henry Watson, of the town of Newcastle-upon-Tyne, brass founder, for improvements in valves and cocks. Patent dated October 12. Six months.

Robert Lakin, of Ardwick, in the county of Lancaster, machinist; and William Henry Rhode, of Openshaw, in the county of Lancaster, mechanist, for certain improvements in machinery, and for preparing, spinning, doubling, and weaving cotton, and other fibrous substances. Patent dated October 12. Six months.

Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury, for improvements in spinning fibrous substances. Patent dated October 12. Six months.—(Communication).

Joseph Low, of Salford, in the county of Lancaster, surveyor, for certain improvements in grates or grids applicable to sewers, drains, and other similar purposes. Patent dated October 12. Six months.

Richard Fitch, of Chelmsford, in the county of Essex, patent salt manufacturer, for improvements in baking bread, biscuits, and other matters, which improvements are applicable for drying goods. Patent dated October 12. Six months.

Cornelius Borrel, of Kempsey, in the county of Worcester, engineer, for certain improvements in rotary engines, to be worked by steam or other means, and also in the construction of carriages, vessels, or other vehicles, to be worked or propelled by the said improvements in rotary engines, or other motive power, and for the machinery to be connected therewith. Patent dated October 12. Six months.

James Banister of Birmingham, manufacturer, for a certain improvement or certain improvements in tubes for locomotive and other boilers. Patent dated October 12. Six months.

George Alois Kingeisen, of Essex street, Strand, in the county of Middlesex, chemist, for a composition or preparation for destroying vermin. Patent dated October 12. Six months.

Charles Rowley, of Newhall-street, Birmingham, button manufacturer, for certain improvements in apparatus for weaving, and in articles to be attached to dresses. Patent dated October 12. Six months.

John Torkinton, of Bury, in the county of Lancaster, railway contractor, for certain improvements in the construction of chairs for railways. Patent dated October 12. Six months.

John Christophers, of Heavitree, in the county of Devon, formerly merchant and ship-owner, for improvements in naval architecture. Patent dated October 12. Six months.

Thomas Lightfoot, of Broad Oak, in the county of Lancaster, chemist, for improvements in printing cotton fabrics. Patent dated October 12. Six months.

Conrad William Tinzel, of the city and county of Bristol, sugar refiner, for improvements in the processes and machinery employed in, and applicable to, the manufacture of sugar. Patent dated October 12. Six months.

John Mercer, of Oakenshaw, in the county of Lancaster, gentleman, and William Blythe of Holland Bank, in the same county, manufacturing chemist, for improvements in certain materials to be used in the processes of dyeing and printing. Patent dated October 12. Six months.

Jules le Bastier, of Paris, gentleman, for certain improvements in machinery or apparatus for printing. Prtent dated October 12. Six months.

Joseph Johnson, of Huddersfield, in the county of York, bricklayer, and Joe Cliffe, of the same place, ironfounder, for improvements in furnaces, or in the means of consuming smoke. Patent dated October 12. Six months.

John Debell Tuckett, of Plymouth, in the county of Devon, merchant, for a new and improved method of preparing a manure called "superphosphate of lime," without using any acids in the decomposition of the various substances of which the manures now in use, and for which patents have been obtained, called "superphosphate of lime," by the application of artificial agency, by which more than double the quantity of a true superphosphate of lime can be produced beyond that for which any patent has hitherto been granted, that the same may be applied in the production of all kinds of crops, more particularly wheat, barley, oats, turnips, and other vegetables. Patent dated October 18. Six months.

Thomas Dawson, of Melton-street, Euston-square, machinist, for improvements in cutting and shaping garments, and other articles of dress for the human body. Patent dated October 18. Six months.

George Shove, of Deptford, in the county of Kent, for improvements in manufacturing ornamented surfaces when glass and other substances are used. Patent dated October 18. Six months.—(Communication.)

Joseph Stovel, of Suffolk-place, Pall Mall East, in the county of Middlesex, tailor, for improvements in coats, part of which improvements are applicable to sleeves of other garments. Patent dated October 18. Six months.

David Hulett, of Holborn, in the county of Middlesex, gas engineer, and John Birch Paddon, of Lambeth, gas engineer, for improvements in gas-meters and in gas regulators. Patent dated October 18. Six months.

Patent Vertical Printing Machine

CTED FOR THE PROPRIETORS OF "THE TIMES"

Y *T. MIDDLETON, Engineer, London*

1849.

A N

THE ARTIZAN.

No. XII.—Fourth Series—DECEMBER 1st 1849.

MECHANICAL ENGINEERING.

APPLEGATH'S PATENT VERTICAL PRINTING MACHINE.

We have the pleasure this month, of presenting our readers with a plate of the new Printing Machine at the *Times* office, which presents a most happy combination of novelty and correctness of principle, with success in the working out.

To enable our readers generally to appreciate the inventive talent displayed by Mr. Augustus Applegath in designing this machine, it will be necessary to describe briefly the state to which fast printing had been brought with the existing machines, and the difficulties which presented themselves to any further increase in their rate of production.

In 1827, Mr. Applegath constructed for the *Times*, a horizontal machine, in which the form of type was fixed on a flat table, and a reciprocating motion given to it by means of a rack and pinion, which caused it to traverse (as in a planing machine) under, and in contact alternately with, four small impression cylinders. Machines on this principle have been employed in printing the *Times*, and also most of the other London newspapers since that date. The form of type, on this plan, has a motion of 176 inches, viz., 88 inches forward, and 88 inches backward—or 44 inches for each sheet of paper printed, and the limit to the speed of a machine on the reciprocating principle, is the having suddenly to stop and reverse the motion of so great a weight as the form of type, iron table, rack, &c., which weighing about a ton, cannot be driven, with any degree of safety, quicker than about 40 to 45 strokes per minute, at that rate producing about 5,000 impressions per hour.

This rate of production being insufficient to satisfy the demands of the public in these days of railways and electric telegraphs, Mr. Applegath turned his attention to the invention of a machine which should surpass the existing machines, as far as they, in their turn, had surpassed those in use before them.

The trouble which the reciprocating machines gave when it was attempted to accelerate their speed, rendered it inadvisable to attempt further improvement in that direction. That the principle itself was bad, no mechanic can avoid seeing; but the horizontal table offered so many facilities for attaching the type and working off the impressions, that no improvements had been introduced without preserving this feature in their construction. The idea of placing the type round a cylinder, is not indeed new. It was proposed in the last century by Nicholson, the father of machine printing, to mount or "impose" the type on a horizontal cylinder, each letter being bevilled laterally to produce the circular periphery. There are two serious objections to this arrangement; first, that the centrifugal force of the type when revolving, *added* to the force of its gravity, would render it almost impossible to hold the type in position; and secondly, that the mechanical methods proposed for locking the numerous types together, would involve so much time and trouble in the composition, as to render it quite inadmissible on the score of economy, if not of time.

We shall now see how these difficulties are overcome in the machine before us.

The ordinary flat type is used, and is arranged in four type-holders (one for each page of the paper). These type-holders are bolted to a large vertical drum, 5 feet 4 inches in diameter, a portion only of the circumference of which they cover. In this position of the type, its gravity neutralizes its centrifugal force, and no difficulty is experienced in keeping it in its place during the revolution of the drum. The columns of type form the sides of a polygon which only deviate in a small degree from the circumference of a circle, and which deviation is compensated for, as will be hereafter explained. Around this central drum are placed eight vertical impression cylinders, at each of which a sheet of paper is printed for every complete revolution of the central drum; the sheet of paper passing round the impression cylinder, and being impressed by the type in its passage past it. By this arrangement, the continuous motion of the central drum is unbroken, all concussion is removed, and the type is, so to speak, never idle; the short space between the printing of the sheets being only sufficient to give a fresh supply of ink to the type, whereas in the reciprocating machine, one-half of each stroke is inefficient. With the same speed of type, therefore, as in the old machine, a much greater production is obtained. The new machine at the *Times* office is at present driven at the rate of 10,080 impressions per hour, or 168 sheets per minute; but that speed can be safely increased to 11,000 or 12,000 per hour—the latter number being the limit at which it can be fed with, and discharged of, sheets of paper of so large a size as the *Times*. Each impression cylinder, at the highest speed above mentioned, will have to be supplied with 1,500 sheets per hour, or one sheet every $2\frac{1}{2}$ seconds, a rate at which, as may be well imagined, there is considerable difficulty in handling the paper.

We will now proceed to consider how these mechanical arrangements are carried out.

a, *a*, is the large vertical drum, forming the centre of the system, mounted on the shaft *b*, *b*, and driven by the bevil wheel and pinion *c*, *d*, the shaft of the pinion *d*, being supported on the floor and carried to prime mover.

f, f, f, f, f, f, f, f, are the eight impression cylinders, driven by the spur wheel *e*; the same speed is therefore secured between the circumference of the drum (with the type) and the circumference of each impression cylinder.

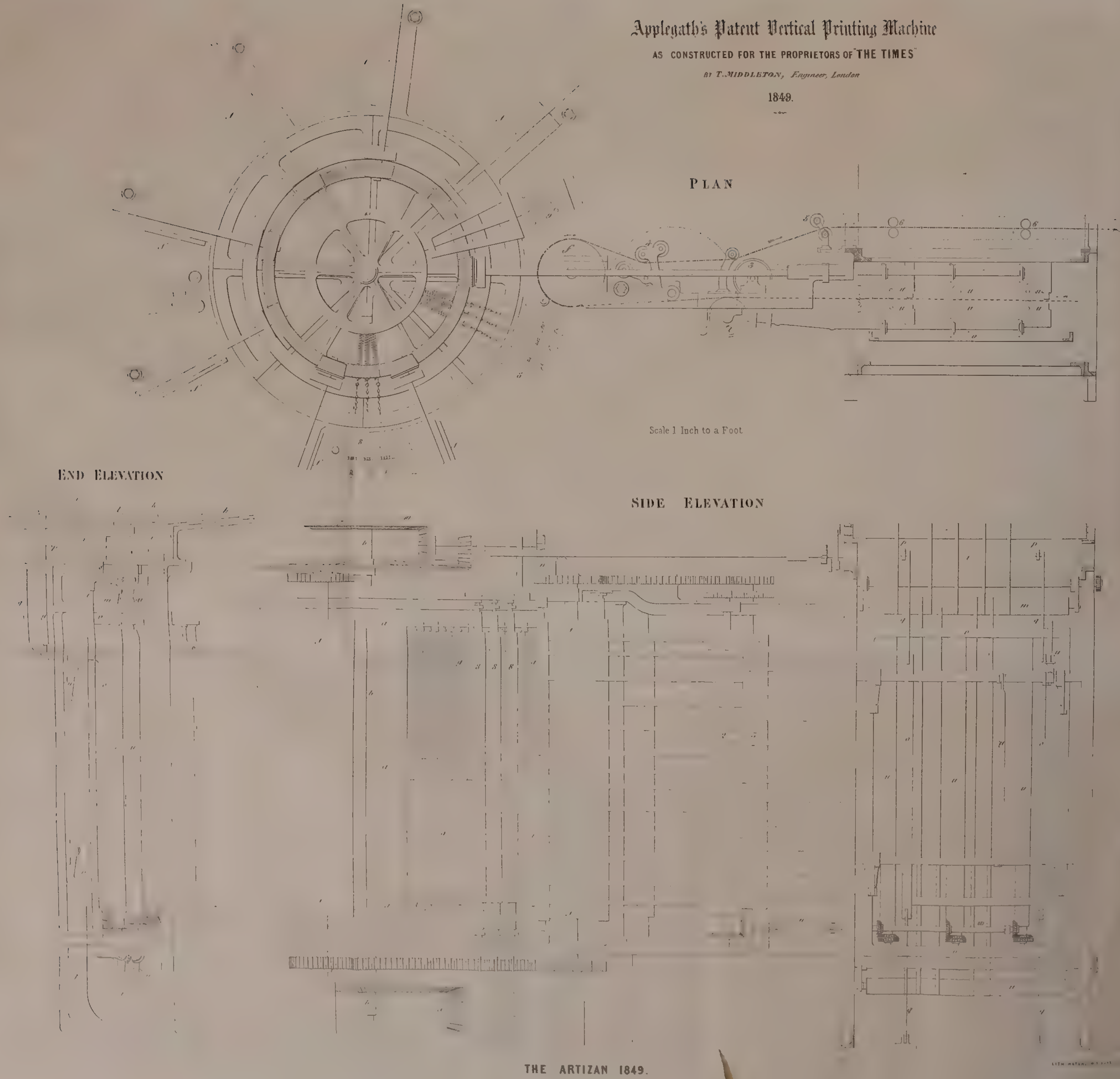
The columns of type, as we have already mentioned, are fixed in the four type holders *g*, *g*, *g*, *g*. Between the columns of type are the "rules," which are fitted into the top and bottom of the type holder in a similar way to a metal saw in its frame. These rules are made like the keystone of an arch, to fill up the space left at the junction of the columns, owing to the angle which the columns form with each other in their position as sides of a polygon. The centre rule in the type holder is a fixture, in order to avoid the possibility of the type escaping from its place, in screwing it up; and each column is jammed up from one end by a set-screw, as shown at top and bottom of the upper and lower type holders. The four pages of type thus prepared, are bolted to the rings of the central drum. It will be observed that the impression cylinders are not arranged symmetrically

Applegath's Patent Vertical Printing Machine

AS CONSTRUCTED FOR THE PROPRIETORS OF "THE TIMES"

BY T. MIDDLETON, Engineer, London

1849.



around the central drum. A greater space is left between one pair than between the others, in order to give room to get at the type, which can only be done when it is in the position shown in the drawing.

Each of the impression cylinders requires an apparatus for supplying it with the sheets of paper, (one only being shown in the plan); and the vertical position of the type requires that the paper shall be also brought to a vertical position and be moved laterally in its passage through the machine. This difficult problem is solved in the following manner:—

The sheets of paper are piled on the feeding board *h* (see end view of feeding apparatus), and are pushed forward, one by one, by the attendant, over the centre of the feeding drum, *i*. *k k* are two small fluted rollers, fixed on the dropping bar, and driven by tapes, off the roller *l*.

At the right moment this bar turns on its centre, *l*, and *k k* drops, as shown in the drawing, and by its motion advances the sheet of paper between the rollers, *i* and *l*. The motion of the sheet is then continued downwards by tapes passing around the rollers, *m m* and *n n*. The paper is steadied in the whole of its course by numerous tapes, only a few of which are drawn to show their direction. The down tapes pass around the feeding roller, and the smaller rollers, *m*, *m*, and *n*, *n*, and carry the sheet with them, until its progress is arrested by two long narrow strips of wood, *o*, *o*, covered with woollen cloth, and called "stoppers," one pair of which are advanced forward against the other pair that are fixed. The motion of this stopper frame is effected by means of the cam *p*, which acts upon the arms *q q*, *q q*, attached to the frame. The rollers *m*, *m*, and *n*, *n*, then (and, of course, the tapes with them) open, and leave the sheet in its vertical position, held up by the stoppers. The opening of the rollers *m*, *m*, and *n*, *n*, is effected by their bearings being mounted in the ends of levers, and these levers are made to act upon each other by means of the toothed segments shown in the drawing. The cam *r*, lifts the link *s*, which moves the top pair of rollers *m*, *m*, while the motion is conveyed to the lower pair, *n*, *n*, by the connecting rod *t*, which is loaded with a weight at bottom to keep the friction roller on the cam *r*.

To return to our sheet of paper, which we left held up by the stoppers. These are now relaxed, and the weight of the paper is taken by two pairs of small finger or suspending rollers at the top of the sheet, which are brought together by a cam, and pressing slightly together, hold the sheet up during the instant of time that the stoppers are relaxing, and until the three pairs of vertical rollers *u u*, *u u*, *u u*, are brought into contact to communicate the lateral motion to the sheet. The vertical rollers are all driven at the same speed as the printing drum by means of bevil wheels and pinions, as shown. The three front rollers *u*, *u*, *u*, are mounted in a hanging frame *v*, *v*, and the pinions at bottom are driven through the bevil pinions and the shaft *w*, *w*, which is made with a universal joint to allow of the motion of the frame *v*, *v*. The back rollers are driven in a similar way, but their centres are stationary.

The proper motion is communicated to the hanging frame *v*, *v*, by a cam, similar to *p*, acting upon the lever and friction pulley *x*, the motion being communicated through the levers *y*, *y*. Immediately on the rollers being brought into contact with the paper, it is advanced by their motion into the mouth of two sets of horizontal tapes, which pass round the drums 2 and 3 (also driven by gearing), and carry the sheet onwards towards the impression cylinder *f*, where it is printed, and whence it returns in the direction of the arrows, the dotted line showing its path. The sheet of paper in its passage out meets with another set of endless tapes at the roller 4, which assist it out as far as the rollers 5, where these tapes return and leave the sheet to complete its course by the action of a single pair of suspending tapes at the top of the sheet, and pressed lightly together by the pullies 6.

On arriving at the outer pulley these tapes are forcibly pressed together by a lever and stopped, and thus hold the sheet of paper suspended and ready for the attendant to draw down, and place on the taking off-board 7 (shown broken off)—an operation very easily performed. Each of the eight impression cylinders is provided with a similar feeding apparatus, and the same action takes place alternately at each, thus producing eight sheets, printed on one side, for each revolution of the central drum.

We may now mention the plan which is adopted to counteract the deviation of the faces of the columns of type from a true circle. Strips of paper are pasted down the impression cylinder, in width equal to each column. Other narrower strips of paper are pasted in the centre of these, and other strips, narrower still, until the surface of the impression cylinder becomes a series of segments of smaller circles, agreeing sufficiently with the required curve, to produce a perfect impression of the type over the whole width of the column.

The ink is supplied to the type by three inking rollers 8, 8, 8, placed between each two impression cylinders. These rollers receive their ink from revolving in contact with a curved inking-table, placed on the central printing drum opposite to the form of type. The ink is communicated to the inking-table by two vibrating rollers alternately in contact with it and the ductor roller. The ductor roller 9, forms one side of an ink-box from which, as it revolves by the bevil gearing 10 and 11, it withdraws a portion of ink. The two ink-boxes are kept full by a reservoir placed above them. The inking rollers are caused to press in contact with the inking table by means of coiled springs, as shown, and their brass bearings are also furnished with set-screws to hold them in close contact with the type, as it passes, in a similar manner to other, quick machines.

The spindles of the inking rollers are also provided with small friction wheels at top and bottom, which run upon a brass bearer on the central drum; by which they are kept from being drawn into the drum by their springs, except at the proper time.

There is an advantage incidental to the vertical position of the type and the paper—viz., that the ink does not sink into the type as it does when it is placed horizontally, and on that account the type is kept much cleaner.

In looking at a copy of the *Times*, it will occasionally be observed that the impression is not exactly in the centre of the paper. Now, the only wonder really is, that it should be so nearly true. The type and the paper move at about the rate of 60 inches per second, so that an error in the arrival of the sheet of paper to the impression cylinder of one-sixtieth of a second would cause an error of one inch in the margin. Yet so accurately is this performed, that the waste of sheets is considerably less with this machine, than with the old horizontal ones.

Some little difficulty was experienced at first in carrying on the paper, when vertical, without buckling it. This difficulty was conquered by introducing an additional roller, to give the paper a slight angle, instead of drawing it out in a straight line, which had the effect of stiffening it, on the same principle as corrugating a plate of iron.

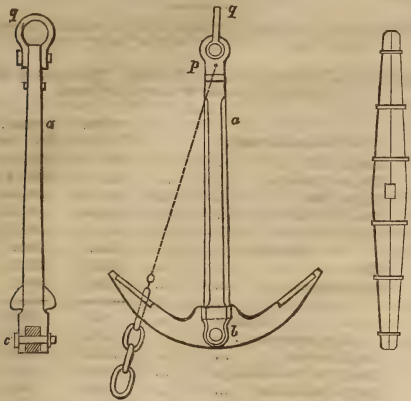
The produce of this machine might readily be doubled, by having two forms of type on the central drum, instead of one, (were it desirable for want of space for two machines, or other reasons) and the addition of eight other laying-on boards, and feeding drums in a story above the present ones.

We are aware that our description hardly does justice to all the ingenious appliances about the machine, but we hope to return to the subject in a future number, and give a more detailed account of some of the points, which we have at present only touched upon but lightly.

COTSELL'S PORTABLE ANCHOR.

THE annexed engravings represent the method of construction invented by Mr. George Cotsell, master smith, H. M. dockyard, Chatham. One of these anchors was made pursuant to Admiralty order, dated 23rd February, 1848, tested at Woolwich, 14th October, 1848, and issued to H. M. S. *Cleopatra*, Thomas L. Massie, Esq., captain, 17th May, 1849. This anchor consists of two pieces, the arms, *b*, and the shank, *a*, which embrace each other at their junction by means of the jaws, through which the pin, *c*, passes, and holds them securely together. Its principal dimensions are the same as the Admiralty anchor. The shank and arms are flattened, to give more strength in the line of strain, and the *inner* surfaces of the arms are kept straight to the proper angle, which will cause the anchor to nip the ground readily, and to hold firmly when once inserted. For the purpose of weighing, or tripping the anchor, the *external* curvature of the arms is preserved. As this anchor presents greater facilities for sound forging than the

ordinary anchor, it can be made cheaper, whilst all the good qualities are preserved, and it can readily be fished and catted.



The following *mean* results were quoted at the trial of this anchor, on the 14th October, 1848:—

	Tons.	Inches.
Deflection at a strain of	10	$0\frac{15}{32}$
" "	20	$0\frac{24}{32}$
" "	30	1—
" "	$35\frac{1}{2}$	$1\frac{5}{32}$

Resumed, when the strain was taken off, three-quarters of an inch.

To enable our readers to understand what these quotations represent, we explain the method of testing an anchor:—

The anchor being placed in the frame of the testing machine, the arm is fixed in an iron shoe, *o*, one-third up the arm from the point. The shackle *q*, is attached to the other end of the frame, by means of a chain; the length of the line, *o p*, is then set off on a measuring rod, and, all being ready, the pumps are set to work, and the elongation of this line, during the process of testing, is called "deflection."

In a solid, or ordinary anchor, this term is very appropriate, but in the present case it is not so; inasmuch as the original lines were undisturbed and the whole elongation of the line, *o p*, was simply the effect of the strain in bringing the parts of junction to their bearing. In a solid anchor, any increase in the line, *o p*, shows that the material has yielded to the strain, and the resumption of its original lines will, of course, be in proportion to the elasticity of the material. As already explained, the "deflection" in this description of anchor is not of that importance which, at first sight, it may appear to be.

Much interest is felt in the result of a practical trial of this anchor, which it is now undergoing. Several experiments are being made, which appear to confirm the favourable opinion entertained of it. For instance, we are informed that an anchor of this description, weighing only twenty ounces, carried the enormous weight of 2,117 lbs., and that the shank, which was rather over its due proportion in weight, was bent to a very sharp curve, without any signs of giving way.

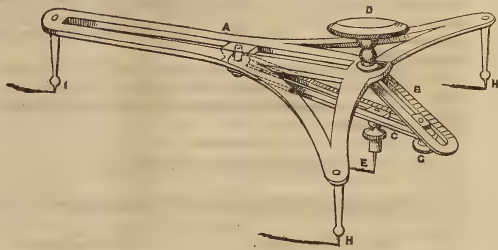
CORRESPONDENCE.

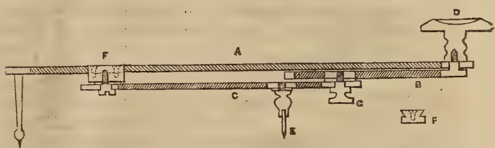
To the Editor of the Artizan.

Sir,

With this I send you the sketch I promised of a modification of the very simple elliptograph figured in the September No. of the *Artizan*, and which, I think, will be found to be a very compact and useful instrument. It will be seen that the alteration principally consists in placing the radial pieces *below* the frame, by which is obtained a greater range in the proportions of the ellipses to be described than is possible by the arrangement shown by "J. S."

To aid any of your readers who may feel inclined to make an elliptograph of this form, I enclose a sectional sketch, with references corresponding with those in the perspective drawing. An instrument measuring seven inches from H to H, and nine inches from I to the middle of the line joining H, H, will describe ellipses from less than one inch to six inches in the longer diameter, and of proportions varying from nearly a mere line to almost a perfect circle. The radial pieces B, C, should be graduated into the *same number* of equal parts, and the dovetail pieces, which slide in them, should be engraved as verniers. If B were graduated so as to read inches from the axis D, representing half of the greater diameter, the divisions on C will stand for inches on the smaller or transverse diameter; but it must be remembered that any number taken on B to represent a semi-axis major, must always be considered to be equal to the whole of the divisions on the arm C. Thus, if the semi-axis minor is to be half the semi-axis major, the pencil or point E must be screwed to the middle of the arm C, &c. The arm C, should be graduated upon the under side.





Your correspondent, "N. D," will probably see, upon reconsidering the matter, that this instrument will describe a *perfect ellipse*, notwithstanding the fact he quotes, "that the piston of a steam-engine is not midway in the cylinder when the crank is at right angles with the piston-rod."

The correctness of the principle upon which this instrument is constructed, admits of being easily demonstrated to any one acquainted with the conic sections.

Falmouth. ... ... W. W. R.

DIMENSIONS AND DETAILS OF NEW STEAMERS.

NORTH LANCASHIRE STEAM NAVIGATION COMPANY'S IRON VESSEL, "HELVELLYN."

Built and fitted by Messrs. William Craig and Co., Hutchesontown, Glasgow.

Builders' Measurement.	Ft.	in.
Length of keel and fore rake	132	2
Breadth of beam	17	0
Depth of hold	8	6
Length of engine space	44	2
Tonnage.	Tons.	
Hull	$188\frac{34}{94}$	
Engine space	$67\frac{20}{94}$	
Register	$121\frac{14}{94}$	

New measurement.	Ft.
Length on deck	131.1
Breadth on ditto amidships	16.5
Depth of hold, ditto	8.3
Length of break-deck	33.0
Breadth of ditto	13.6
Depth of ditto	1.1
Length of engine space	44.2
Tonnage.	Tons.
Hull	$147\frac{28}{100}$
Break-deck	$5\frac{34}{100}$
Gross	$152\frac{62}{100}$
Engine space	$65\frac{51}{100}$
Register	$87\frac{11}{100}$

One side lever engine of 70-horse nominal power. Cylinder, 46 ins. diam. × 3 ft. 8 ins. stroke. Paddle wheels—extreme diam. 15 ft. 6 ins.; ditto effective, 15 ft. Floats, 6 ft. 8 in. × 1 ft. 6 in. Two sets of 14 arms and floats. Three floats in the water, at a draught of 3 ft. 6 ins. forward, and 4 ft. 6 ins. aft. Revolutions per minute, 32. Eight strakes of plates from keel to gunwale. A new tubular boiler has been lately fitted by Messrs. Caird and Co.

The *Helvellyn* plies between Fleetwood, Lytham, and Peel, with passengers. She has a bust female figure head, no galleries, standing boltsprit, two masts, schooner-rigged, and is a square-sterned and clinker-built vessel. Port of Fleetwood.

THE IRON STEAMER, "SOVEREIGN."

Built and fitted by Messrs. Tod and M'Gregor, Glasgow.

Builder's Measurement.	Ft.	in.
Length of keel and fore rake	139	9
Breadth of beam	17	0
Depth of hold	8	4
Length of engine space	40	1
Tonnage.	Tons.	
Hull	$201\frac{53}{94}$	
Engine space	$62\frac{35}{94}$	
Register	$139\frac{18}{94}$	
New measurement.	Ft.	
Length on deck	138.8	
Breadth on ditto amidships	16.5	
Depth of hold, ditto	8.2	
Length of engine space	40.1	
Tonnage.	Tons.	
Hull	$134\frac{99}{100}$	
Engine space	$58\frac{70}{100}$	
Register	$76\frac{29}{100}$	
Diameter of cylinder	49 ins.	
	Ft.	in.
Length of stroke	4	2
Diameter of paddle-wheels, extreme ...	17	6
Ditto, ditto, effective	17	0
Length of floats	6	0
Breadth of ditto	1	2

One steeple engine of 82-horse nominal power. Two sets of 8 arms and 16 floats. Frames, $2\frac{5}{8}$ ft. × $2\frac{5}{8}$ ft. × $\frac{3}{8}$ in., and 2 ft. 6 in. apart. Bunkers hold seven tons of coals. Average, 33 revolutions per minute. Steam pressure, 9 lbs. Speed, $14\frac{3}{4}$ miles per hour. One tubular boiler, 5 furnaces. Draught of water, 5 feet. She makes three trips per day between Glasgow, Port Glasgow, Greenock, Helensburgh, Row, Roseneath, and Garelock, with passengers, &c. The property of Messrs. Henderson and M'Kellar. Captain, Mr. John M'Aulay. Crew, ten in number—three in cabin, three in engine room, and four on deck.

Bust female figure head (the Queen), no galleries, one mast, sloop-rigged, standing boltsprit, and is a square-sterned and clinker-built vessel. Port of Glasgow.

THE WEST INDIA ROYAL MAIL STEAM NAVIGATION COMPANY'S VESSELS, "CLYDE" AND "TEVIOT," "SOLWAY" AND "TWEED."

Built by Messrs. R. Duncan and Co., Greenock. The engines by Messrs. Caird and Co., similar to those of the *Tweed*.

	CLYDE.		TEVIOT.	
Builder's measurement.	Ft.	ins.	Ft.	ins.
Length aloft	215	0	217	5
Keel and fore rake	213	1	214	1
Engine space	81	0	80	0
Breadth of beam	36	10	36	1
Depth of hold	31	2	30	11
Tonnage.	Tons.		Tons.	
Hull	$1378\frac{20}{94}$		$1332\frac{66}{94}$	
Engine space	$584\frac{50}{94}$		$554\frac{4}{94}$	
Register ...	$793\frac{64}{94}$		$778\frac{62}{94}$	
New measurement.	Ft.		Ft.	
Length on deck	213.1		217.2	
Breadth on ditto amidships ...	34.5		33.7	
Depth of hold, ditto	30.9		30.6	
Length of engine space	81.		80.0	
Depth of ditto	22.9		23.5	
Height of spar deck	8.0		7.1	
Tonnage.	Tons.		Tons.	
Hull	$1842\frac{362}{3500}$		$1793\frac{470}{3500}$	
Engine space	$682\frac{1886}{3500}$		$671\frac{1500}{3500}$	
Register ...	$1159\frac{1976}{3500}$		$1121\frac{2470}{3500}$	

	SOLWAY.		TWEED.	
Builder's measurement.	Ft.	ins.	Ft.	ins.
Length aloft	215	11	217	2
Keel and fore rake	215	11	215	0
Engine space	77	0	81	0
Breadth of beam	35	6	36	9
Depth of hold	29	11	31	8
Tonnage.	Tons.		Tons.	
Hull	$1304\frac{56}{94}$		$1386\frac{11}{94}$	
Engine space	$516\frac{14}{94}$		$581\frac{84}{94}$	
Register ...	$788\frac{42}{94}$		$804\frac{21}{94}$	
New measurement.	Ft.		Ft.	
Length on deck	213.6		215.0	
Breadth on ditto amidships ...	33.4		33.8	
Depth of hold, ditto	29.6		31.4	
Engine space	77.0		81.0	
Depth of ditto	22.2		23.4	
Height of spar deck	7.4		8.0	
Tonnage.	Tons.		Tons.	
Hull	$1871\frac{334}{3500}$		$1828\frac{2350}{3500}$	
Engine space	$604\frac{3321}{3500}$		$683\frac{287}{3500}$	
Register ...	$1266\frac{513}{3500}$		$1145\frac{2063}{3500}$	

The *Solway* was built by Messrs. J. M'Millan and Co., Greenock. The engines by Messrs. Scott, Sinclair, and Co.

Side lever engines of 434-horse nominal power. Cylinders, 73 ins. diameter, and 7 feet stroke. Air-pumps, $41\frac{3}{4}$ ins. diameter. Paddle-wheels, diameter, extreme, 29 ft. 8 ins.; ditto, effective, 29 feet. Floats, 9 ft. 6 in. × 2 ft. 6 in. Three sets of 20 arms and floats.

Gudgeons in ends of side levers, $6\frac{5}{8}$ in. dia. × 7 ins. Crank pin, 9 ins. diameter × $10\frac{7}{8}$ ins. Crank shaft bearing, $14\frac{7}{8}$ × $18\frac{1}{4}$ ins. Motion shaft ditto, $4\frac{1}{8}$ in. × $8\frac{7}{8}$ in. Weigh shaft ditto, $5\frac{5}{8}$ in. × $8\frac{7}{8}$ in.

Three return-flue boilers, with a double tier of furnaces, for dimensions of which see "*Artizan Treatise on the Steam Engine.*"

The *Solway* was the largest vessel ever built in Scotland, with the ex-

ception of the *Simoom*, iron screw frigate, and was lost in 1843, near Corunna.

Description—Two decks, flush; three masts, schooner-rigged, a standing boltsprit, false quarter galleries, full female figure head, and a round-sterned and carvil-built vessel of timber. Commander, Mr. James Duncan, who was lost in her.

The *Tweed* was built by Messrs. Thompson and Speirs, Greenock; the engines by Messrs. Caird and Co. A pair of side lever engines of 486-horse nominal power. Cylinders, $74\frac{1}{2}$ ins. diameter × 7 ft. 6 ins. stroke. Paddle-wheels, diameter, extreme, 30 ft. 2 ins.; ditto effective, 29 ft. 6 ins. Floats, 10 ft. 6 in. × 2 ft. 6 in. Three sets of 21 arms and floats. (All the details of these engines will be found in the "*Artizan* Treatise on the Steam Engine.")

Description—Two flush decks, three masts, schooner-rigged, standing boltsprit, full male figure head, false quarter galleries. a round-sterned and carvil-built vessel of timber. It will be remembered that she was lost on the Alacranes reefs, near which spot the *Forth* was wrecked in the spring of this year.

THE IRON STEAM-VESSEL, "ENGINEER."

Built and fitted by Messrs. James and William Napier, Swallow Foundry, Anderston, Glasgow, 1843.

	As originally built.		After being lengthened.	
Builder's measurement.	Ft.	in.	Ft.	in.
Length of keel and fore rake ...	149	$3\frac{1}{2}$	161	3
Breadth of beam	18	$1\frac{1}{2}$	18	$1\frac{1}{2}$
Depth of hold	8	0	8	2
Length of engine space	69	1	87	1
Tonnage.	Tons.		Tons.	
Hull	$260\frac{69}{94}$		$294\frac{40}{94}$	
Engine space	$139\frac{55}{94}$		$163\frac{91}{94}$	
Register ...	$121\frac{14}{94}$		$130\frac{43}{94}$	
New measurement.	Ft.		Ft.	
Length on deck	150.0		168.0	
Breadth on ditto amidships ...	17.6		17.6	
Depth of hold, ditto	7.8		8.0	
Length of quarter-deck	35.0		35.0	
Breadth of ditto	15.2		15.2	
Depth of ditto	0.7		0.7	
Length of engine space	69.1		87.1	
Tonnage.	Tons.		Tons.	
Hull	$166\frac{85}{100}$		$197\frac{31}{100}$	
Quarter deck	$4\frac{0}{100}$		$4\frac{0}{100}$	
Gross	$170\frac{85}{100}$		$201\frac{31}{100}$	
Engine space	$102\frac{66}{100}$		$132\frac{72}{100}$	
Register ...	$68\frac{19}{100}$		$68\frac{59}{100}$	

One steeple engine of 104-horse nominal power. Diameter of cylinder, $54\frac{1}{2}$ ins. Length of stroke, 4 ft. 6 ins. Diameter of paddle wheels, extreme, 18 ft.; ditto, ditto, effective, 17 ft. 7 in. Length of floats, 6 ft. 9 in.; breadth of ditto, 1 ft. Two sets of 16 arms and floats.

Four cylindrical boilers, 8 ft. diameter and 16 ft. long, 2 of them afore and 2 abaft the engine, and fired from the engine room, with 2 funnels. There were formerly 32 floats of 6 ins. in breadth, and the same length as the present. Draught of water, forward, 5 ft.; aft, 5 ft. 6 ins In August, 1844, went from Glasgow to Ayr in 5 h. 5 m., returning in 5 h. 10 m. (eighty miles), being at the rate of 16 miles per hour. Plyed between Glasgow, Kilman, Rothesay, &c., with passengers. At present she plies on the Mersey at Liverpool. This steamer had the longest engine room ever built on the Clyde.

The *Engineer* has a full male figure head, no galleries, standing boltsprit, two masts, schooner-rigged, main and quarter decks, and is a square-sterned and clinker-built vessel Port of Liverpool.

DUBLIN, CORK, AND GLASGOW STEAM NAVIGATION COMPANY'S IRON STEAM VESSEL, "VANGUARD."

Built and fitted by Mr. R. Napier, Glasgow.

Builder's measurement.	Ft.	in.
Length of keel and fore rake	182	5
Breadth of beam	27	3
Ditto, over the paddle-cases	46	4
Depth of hold	16	7
Length of engine space	70	11
Tonnage.	Tons.	
Hull	$662\frac{84}{94}$	
Engine space	$287\frac{7}{94}$	
Register	$375\frac{77}{94}$	
New measurement.	Ft.	
Length on deck	182.9	
Breadth on ditto amidships	26.3	
Depth of hold, ditto	16.4	
Length of engine space	70.9	
Tonnage.	Tons.	
Hull	$697\frac{11}{100}$	
Engine space	$330\frac{95}{100}$	
Register	$366\frac{16}{100}$	

Two side lever engines of 324-horse nominal power. Cylinders, 65 ins. diameter × 5 ft. 10 in. stroke. Paddle wheels, diameter, extreme, 27 ft. 1 in.; ditto, ditto, effective, 26 ft. 5 in. Floats, 8 ft. 3 in. × 2 feet. Three sets of 20 arms and floats. Three flue boilers and 10 furnaces. Pressure of steam, 7 lbs. Consumption of fuel, 22 cwt. coals per hour. Contents of bunkers, 84 tons. The total consumption on the whole distance from Glasgow to Greenock, Dublin, and Cork, and back, is 98 tons, the distance being 868 miles, which is performed in 64 hours, deducting stoppages at the above-mentioned ports.

Average draught of water, 11 feet forward and 12 feet aft. Frames, $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ in. 12 in. apart at midships, tapering fore and aft to 18 ins. apart.

Crew, 26 in all—viz., 13 in the captain's department, 8 in the engineer's, and 5 in the steward's.

The *Vanguard* was the first iron vessel built by Mr. R. Napier, at Govan, and was launched 29th June, 1843.

She has three masts, schooner-rigged, a standing boltsprit, clipper bow, mock quarter galleries, full male figure head ("British Tar"), and is a square-sterned, clinch and carvil-built vessel, with main and break decks. Port of Dublin. Commander, Mr. Robert Ewing.

STEAM DREDGING MACHINE AT FLEETWOOD-ON-WYRE.

Built in 1840 by Messrs. Menzies, of Leith. The machinery by Messrs. James B. Maxton and Co., ditto.

Builder's measurement.	Ft.	in.
Length aloft	86	$8\frac{1}{2}$
Length of keel and fore rake	86	0
Breadth of beam	24	2
Breadth over the paddle-boxes	33	$10\frac{1}{2}$
Depth of hold	7	6
Length of bucket-well	50	2
Breadth of ditto	4	2
Tonnage.	Tons.	
Hull	$223\frac{3}{94}$	
Bucket-well	$2\frac{72}{94}$	
Register	$220\frac{25}{94}$	
New measurement.	Ft.	
Length on deck	82.9	
Breadth on ditto amidships	22.5	
Depth of hold, ditto	7.2	
Length of bucket-well	50.2	
Breadth of ditto	4.2	

Tonnage.	Tons.
Hull	$130\frac{2018}{3500}$
Bucket-well	$1\frac{694}{3500}$
Register	$129\frac{1424}{3500}$

One side lever engine of 14-horse nominal power. Cylinder, 22 ins. diameter × 3 feet stroke. Paddle-wheels, diameter, extreme, 10 ft. 5½ in.; ditto, ditto, effective, 10 ft. 1 in. Floats, 3 ft. 6 in. × 1 ft. 3 in. Two sets of arms, 10 in each. Three floats in the water. Draught, 5 ft. 6 in. forward, and 5 feet aft.

One rectangular flue boiler, two furnaces. Steam pressure, 3½ lbs. Consumption of fuel, 2 cwt. per hour, or 5 tons per week average. Length of bucket ladder between centres, 51 ft 6 ins, having 31 buckets.

The engine makes 50 revolutions per minute, lifting 140 tons of soft sand or mud in the hour; and 40 tons of hard sand or gravel, the engine making 20 revolutions.

The vessel is carvil built, and the paddle wheels are thrown in gear when it is required to move her about the river.

The deck is flush, with the ladder amidships, discharging over the stern into pontoons, of which there are 14 in use. These pontoons are 31 ft. 4 in. long, 14 ft. 8 in. broad, and 3 ft. 6 in. deep, equal to $27\frac{37}{94}$ tons. They carry about 20 tons each, and have folding doors at bottom, through which, when lowered, the mud is discharged, the doors being lifted again by a small winch. Each of the pontoons is attended by two men. The dredger has a crew of nine men, including two in engine room, and the weekly expenses average £12 for wages, exclusive of coals, oil, tallow, and other engineer's stores. I saw this machine lift 45 tons in 14 minutes (including the shifting of the pontoons) when working in 11 ft. 6 in. water. F. B.

THE NORTH LANCASHIRE STEAM NAVIGATION COMPANY'S IRON VESSELS, "HER MAJESTY" AND "ROYAL CONSORT."

Builder's measurement.	Her Majesty.		Royal Consort.	
	Ft.	in.	Ft.	in.
Length of keel and fore rake ...	180	0	180	0
Breadth of beam	26	3	26	3
Ditto over paddle boxes	45	3	45	3
Depth of hold	15	5	15	5
Length of engine space	54	2	54	2
Tonnage.			Tons.	
Hull	$604\frac{46}{94}$		$604\frac{46}{94}$	
Engine space	$179\frac{49}{94}$		$179\frac{49}{94}$	
Register ...	$424\frac{49}{94}$		$424\frac{49}{94}$	
New measurement.	Ft.		Ft.	
Length on deck	178.1		177.9	
Breadth on ditto amidships ...	25.2		25.2	
Depth of hold, ditto	15.2		15.2	
Length of quarter-deck	56.4		56.3	
Breadth of ditto	22.6		22.6	
Depth of ditto	1.0		1.0	
Length of engine space	54.2		54.2	
Tonnage.	Tons.		Tons.	
Hull	$507\frac{29}{100}$		$508\frac{18}{100}$	
Quarter deck	$13\frac{79}{100}$		$13\frac{77}{100}$	
	$521\frac{8}{100}$		$521\frac{95}{100}$	
Engine space	$224\frac{68}{100}$		$224\frac{68}{100}$	
Register	$296\frac{40}{100}$		$297\frac{27}{100}$	

A pair of steeple engines in each vessel of 316-horse nominal power, by Messrs. Tod and M'Gregor. Cylinders, 65 ins. diameter × 5 ft. 6 ins. stroke. Air pumps, 25 ins. diameter × 4 ft. 6 ins. stroke. Paddle-wheels, diameter, extreme, 27 feet; ditto, ditto, effective, 26 feet 6 ins. Floats, 7 ft. × 1 ft. 10 ins. Three sets of 26 arms and floats. Tubular boilers, for details of which see "*Artisan Treatise on the Steam Engine.*"

Number of revolutions per minute, 19 average. Passage between Fleetwood and Troon, 147 miles, performed in 12½ hours, on an average. Consumption of fuel, 27 cwt. per hour. Bunkers hold 48 tons of coals. Frames of vessels, 4½ × 4½ × ⅝ ins., and 1 ft. 9 in. apart.

The crew consists of 24 hands—viz., 10 in captain's department, 10 in the engineer's, and 4 in the steward's.

These vessels formerly ran between Fleetwood and Ardrossan, but were afterwards changed to Troon. *Her Majesty* was lost in March last, on a voyage from Londonderry to Fleetwood.

These vessels, according to the Admiralty survey in 1845, are capable of carrying one long 32-pounder gun, and eight 24-pounders.

Description—three masts, schooner-rigged, standing boltsprit, sham quarter galleries, square sterns, clipper bows, clinch and carvil-built vessels of iron. Commander of *Royal Consort*, Mr. P. M'Kellar.

THE NORTH LANCASHIRE STEAM NAVIGATION COMPANY'S IRON VESSEL, "ORION."

Built by Mr. Reid, Ipswich, in 1841. The engines by Messrs. Lloyd and Easter, London.

	Ft.
Length on deck	160.1
Breadth on ditto, amidships	21.5
Depth of hold, ditto	9.6
Length of engine space	42.0
Tonnage.	Tons.
Hull	$252\frac{2625}{3500}$
Engine space	93
Register	$132\frac{2625}{3500}$

A pair of side lever engines of 102-horse nominal power. Cylinders, 40½ ins. diameter × 3 ft. 4 in. stroke. Cycloidal paddle wheels, diameter, extreme, 17 ft. 9 in.; ditto, ditto, effective, 17 ft. 3½ in. Floats, 8 ft. × 1 ft. 3 in. Three sets of 16 arms and floats. Average, 27 revolutions per minute. Steam pressure, 9½ lbs.

The former boilers had 4 furnaces, 4 feet long, and 80 tubes, 5⅝ ins. diameter. The present boilers have four furnaces, 6 feet long, and 360 tubes, 3 ins. diameter. The consumption of fuel with the old boilers was 16 cwt. of coals per hour; with the present boilers it is only 8 cwt. per hour. The bars of the present boiler were thought at first too long, and were shortened to four feet; but, as the consumption was increased by this alteration, the bars were again lengthened to 6 feet.

The engines were the first marine engines made by Messrs. Lloyd and Easter, and are a very substantial job, being almost as good now as when first started. She makes the passage between Fleetwood and Bardsea in 1 hour and 45 minutes, and thence to Liverpool.

The *Orion* has one flush deck, two masts, schooner-rigged, standing boltsprit, bust male figure head, mock quarter galleries, and is a square-sterned and clinch and carvil-built vessel of iron. Port of Fleetwood. Commander, Mr. J. J. Wheeler.

THE WATERFORD STEAM NAVIGATION COMPANY'S IRON SCREW VESSEL, "MARS."

Built by the Company at Waterford, and fitted with engines by Messrs. Smith and Rodger, of the St. James's Foundry.

	Ft.	in.
Length between perpendiculars	180	0
Breadth, extreme	30	6
Depth of hold	16	0
Tonnage	$805\frac{81}{94}$	

The *Mars* is now being fitted in the Broomielaw with a pair of Mr. D. Napier's patent four-piston rod steeple engines of 98-horse nominal power, and 140-horse actual power. Cylinders, 40 ins. diameter × 3 ft. stroke. Two-bladed screw, 9 ft. diameter, worked by spur gearing. Tubular

boilers containing 300 tubes. Frames, 3½ in. × 2⅝ ins. × ½ ins. and 2 ft. 3 ins apart.

The *Mars* has three tall masts, schooner-rigged, clipper bow, square stern, a poop, and also a hurricane deck amidships, 42 feet long, 7 ft. 9 in. high, and the breadth of the ship. She is intended for the trade between Liverpool and Waterford, in connexion with the *William Penn,* paddle steamer, and the *Diana,* screw steamer.

Her sailing properties, under canvas alone, were severely tested in the run from Waterford to the Clyde, under the command of Captain Daniel McLeish; the distance, 364 miles, being performed in 32 hours. She had about 260 tons of ballast on board, and drew 7 ft. 8 ins. forward, and 9 ft. 5 ins. aft.

F.B.

THE SOCIETIES.

ROYAL CORNWALL POLYTECHNIC SOCIETY.

(*Continued from page* 260.)

Method of regulating the flow of the injection water into the condenser, applicable principally to Marine Engines, by G. J. Cunnack.—The injection water, as is at present the general practice, being allowed to flow into the condenser in an uninterrupted stream, and requiring the constant attention of the engineer, so as to proportion the quantity of injection to the bulk of steam proceeding from the engine, this latter must be subject to great variation, particularly in the case of marine engines when the paddles are exposed to the action of a heavy sea, which at times almost brings them to stand-still; and as the injection water still flows, the air-pumps become subjected to a severe strain resulting from the partial choking produced by the excess of water. On the other hand, should the speed of the engines become accelerated, and the injection remain unaltered, a loss of power must ensue from imperfect condensation. The manner in which it is proposed to remedy these irregularities is, by causing the difference of pressure in the condenser to act on a throttle-valve in the injection-pipe, similar in construction and effect to the one in the steam-pipe connected with the governor in land-engines. A small cylinder of any requisite diameter, open at the bottom to the condenser, and at the top to the atmosphere, is fitted with a piston, the rod of which is connected by means of levers, on the one side with a balance or spring, and on the other with the governing lever of the throttle-valve in the injection-pipe. The lower end of the cylinder being open to the condenser, the piston will be subjected to the pressure arising from the vapour within it, this being usually computed at 5 lbs. per square inch; the atmosphere acting on the top of the piston with a force of 15 lbs. to the inch, would leave a force tending to depress it in the cylinder, of 10 lbs.—A weight, acting by means of the long lever, is so arranged as to compensate for this difference, and keep the the piston in equilibrium so long as the pressure in the condenser remains at the proper point, namely 5 lbs. to the square inch. Supposing that from an insufficient supply of injection water, this pressure should be exceeded, the piston will rise, and lifting with it the end of the lever connected with the throttle-valve in the injection-pipe, will increase the flow of water and produce the required effect of more perfectly condensing the exhaust-steam. On the other hand, should the flow become too great, so as to carry the amount of rarefaction too far, the piston would be depressed from the preponderance of atmospheric pressure, and the action on the throttle-valve would be reversed, so as to diminish the quantity of water flowing through it. The piston not being exposed to the action of heat, can be easily kept air-tight by a packing of soft leather; and, if necessary, a small quantity of oil kept on the top of it would be an additional security against leakage. There is a spring in the cylinder, to prevent the too sudden rise of the piston and ensure its gradual action on the throttle-valve of the injection-pipe. The latter valve is supposed to be placed between the injection-cock and the condenser.

Improved Machine for engraving parallel lines on Copper and Steel Plates, by J. Williams.—The proposed alteration in the ordinary machine consists in placing the cross traversing piece upon V shaped guides, working in four indented steel studs on its under side, these being ground together until the whole move freely and steadily. Also in the disposition of the levers for effecting its motion, and the application of a base attached to the frame by four screws at the corners, by means of which the plate to be engraved on is retained in its place, and prevented from shifting until the operation is completed.

Appold's Centrifugal Pump for draining Marshes.—This model of a centrifugal pump, it was stated, would discharge ten gallons of water per minute; it was only one inch in diameter. One of the same shape, 12 inches diameter, will discharge at the same speed of the outside circumference, or one twelfth the number of revolutions, 1440 gallons per minute, being according to the square of the diameter, and not according to the cubic contents. From various experiments, it has been ascertained that the larger model with curved vanes does the most duty on account of its receiving and delivering the water more obliquely; it will discharge 1800 galls. per minute, with 607 revolutions, but does the most duty at 535 revolutions, discharging 1400 galls. Therefore, if a pump one inch diameter raises 10 galls., and another, one foot diameter 1400 galls., it follows that one

	per minute.
10 feet diameter, of the best shape, will pump.........	140,000
20	560,000
40	2,240,000

To do the above duty, the circumference of the 20 feet pump would be required to travel 560 yards per minute, which would be only 53½ revolutions, and the 40 feet 26¾. From the results of various experiments it has been found that the loss of power would not be more than 25 per cent. It will be observed that the centrifugal force is not so much in the large diameter, on account of the water moving more in a straight line; but that is compensated for by the force being applied to a greater depth of water, being 10 feet in the 40 feet, and only 3 inches in the 12 inch. 159 revolutions with the 12 inch will raise the water one foot high without discharging any.

318 revolutions will so raise it..........................	4 feet high.
636	16 ,,
1272..	64 ,,

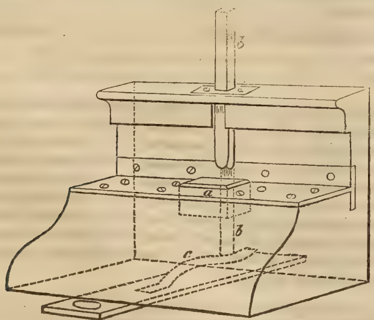
The highest elevation to which the water has been raised with the 12 inch pump is 67 feet 8 inches, 1322 revolutions per minute, being less than the calculated height, which may be accounted for by leakage with the extra strain.—While the 12 inch pump is raising 8 tons of water 5 feet 6 inches high per minute, there is no greater strain on any part of the pump than 160 lbs. on the 6 inch drum, which is equal to a leverage of 3 inches. It will pass almost anything that is small enough to go through, there being no valves. A quantity of nutgalls (about half a gallon) were thrown into the 12 inch pump all at once, when it was at full speed, and they passed through without breaking one.

Improved Safety Valve, by J. Williams.—The purpose of this invention is to obviate the inconvenience experienced from the sticking of the safety valve to the seating, and also to prevent explosion from the falling of the surface of the water in the boiler below the top of the tube. The sticking of the safety-valve to its seating is caused by the weight of the atmosphere acting upon it; when, from any cause, the steam in the boiler has been suffered to get low, its adhesion is frequently so close as to allow of its being moved with difficulty by a lever; when this is unobserved by the engine-man, the steam being unable to find a vent, increases until the pressure is raised to a dangerous extent, and unless attention is attracted

by an unusual speed in the working of the engine, sometimes terminates in the bursting of the boiler. To prevent this, there are two valves made in the top of the boiler of unequal areas, the smaller opening downwards into it, and the larger upwards as in the ordinary safety-valves; these are connected to each other by a lever with equal arms placed between them, so that the raising of one causes an equal depresssion of the other, and the reverse. On the steam being raised in the boiler, the valves will re-act on each other; but that which opens upwards, on account of its greater area, will overcome the pressure on the other, and forcing it down, will permit the escape of the steam from both orifices until its excess of surface is loaded to the necessary degree, the weight required for which will be very small. Should the pressure of the steam get below that of the atmosphere, the latter acting on both valves will cause a similar compensation to take place on the outside, and its force exerted only on the difference of their surfaces (which should be very little) will be insufficient to produce this inconvenience. From the inside of the smaller valve is hung a float, by means of a copper chain of sufficient weight when depending from it to overcome the valve on the opposite end of the lever, and lift it together with its loading, off its seat. The length of the chain is so adjusted that while the float remains on the water above the upper part of the tube, it hangs loosely; but on the former sinking below, the chain is brought to its full stretch, and the float, acting on the valve, opens it, and lets off the steam, thus removing all chance of the occurrence of those dangerous explosions of which this is the fertile source.

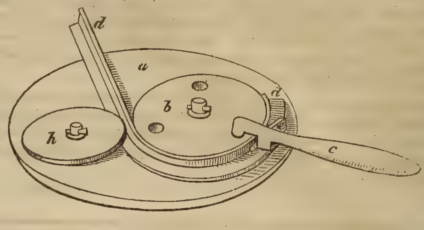
On the means of preventing the corrosion of Steam Boilers.—The writer proposes to effect the prevention of the corrosive action exerted by the water on the interior of boilers, by applying over the whole of the inside a thin coat of varnish, of such a nature, that while it would remain unaffected by the high temperature to which it would be exposed, it should offer no serious resistance to the regular transmission of heat from the iron to the water. To effect this object, he proposes to pour a small quantity of coal tar into the water, immediately before the steam is about to be got up. This substance possesses the singular property, when thrown into boiling water, of parting with its volatile portions, and diffusing the remainder of its substance as a hard insoluble pitch all over the interior of the vessel, effectually preventing a sufficiently close contact between the water and sides to allow of chemical action, while it is so superficial as not to impair the efficiency of the boiler by lessening the conducting power of its surface.

Improved Saw Setting Machine, by J. Harris, of Camborne.—This



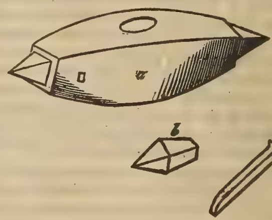
machine is designed to facilitate the operation of setting the teeth of saws. It consists of a small anvil *a*, embedded in a table, upon which the saw is rested, while the teeth are struck by the punch *b*, *b*. The spring *c*, raises the punch after it has been depressed by the blow of the hammer, and the saw being moved along two teeth, is ready for the next blow. The anvil has a different bevil on each side, so that by shifting its position and the punch, saws of different sizes can be readily set to an exact amount of way. This invention received the second bronze medal.

Improved Angle Iron Press, adapted for bending angle iron, by W. Burrall, of Hayle Foundry.—This is a simple contrivance for bending



angle iron to any determinate curve. The angle iron *d*, *d*, is bent over the disc *b*, which, with the similar disc *h*, is mounted on the sole plate *a*. The disc *b*, is turned by the lever *c*, the end of which is dropped into one of the three holes in *b*, while it is dragged round. The angle iron is prevented from slipping by the wedge *e*, driven in between the snug on the lever and the angle iron. This machine has been used for some time, and is found to effect a great saving in time and trouble. The inventor was rewarded with the second silver medal.

Improved Pick, by F. Mitchell, of Redruth.—The design of this



invention is to obviate the complaint among stone cutters and cleavers, that their work being generally at a distance from a smithy, they are not able to obtain sharp tools as often as they want them, unless they waste much time in getting them sharpened; and if they carry with them in the morning, a sufficient number of tools to serve for the whole day, they are seriously incommoded by the weight—the picks alone frequently weighing from 40 to 50lbs. These inconveniences are obviated by the use of the improved pick, inasmuch as six sharp points, of about 1lb. each, suffice for a whole day. The *bodies* of the picks *a*, having scarcely any wear, are exceedingly durable, and not liable to go out of repair. The *points* *b*, are of cast steel, which, it is stated is much better suited for granite or any other hard rock, than blister steel, the kind generally used. The points are held firm by putting a thin piece of leather or other material on two of the sides of the recess, and are got out from behind by driving a small steel key *c*. The cost of these picks is stated to be not half so much as that of common picks, to do the same work per day. This invention received a first prize.

Statistics of Bee-keeping.—Mr. Rundell explained some diagrams which presented records of various curious facts connected with bee-keeping. By suspending a hive to a Salter's balance, the writer (Mr. G. Fox, of Kingsbridge) was enabled to ascertain various statistical facts in the economy of the hive—as, for instance, the amount of honey treasured from day to day throughout the summer—the irregularity of working on the part of the community of the bees, as they were affected by favourable or uncongenial weather—their exits and entrances—their hours of working—and various other facts interesting, and, we presume, not without use, to the attentive apiarian. These facts are ascertained by the observed variance in the weight of the hive as it hangs on the balance.

INSTITUTION OF MECHANICAL ENGINEERS.

ON THE ECONOMY OF RAILWAY TRANSIT, BY MR. SAMUEL.

The object of the present paper is to show that the Locomotives now in use on most of the railways have outgrown the wants of the Passenger Traffic, and that the weight on the driving wheels of these locomotives, amounting in some cases to 14 tons, is perfectly unnecessary for the number of passengers conveyed in 99 cases out of 100.

For the purpose of obtaining practical data upon this subject, the writer of the present paper procured a return for the number of Passengers conveyed on the Eastern Counties and Norfolk Railways, both Main Line and Branches, by each train during the week ending 7th May, 1849; this return showing the greatest number of passengers in each train at any one time.

It appears from this return that the greatest number of passengers in any main line train at any one time was 231, and the least number 7; the greatest number in any of the Branch line trains being 82, and the least number 3.

And by another return from the books of the company it appears that there were conveyed on the Eastern Counties Branch Lines, during the year 1847, 42,644 tons of passengers (calculating each passenger with his luggage at 168 lbs.), and that the weight of engines and carriages required to convey them was about 1,112,500 tons, being in the proportion of 26 to 1.

On examining the coke returns it also appears that the main line engines consumed from $24\frac{1}{4}$ to $40\frac{1}{2}$ lbs. per mile and the engines for working the branch line trains consumed from $16\frac{1}{2}$ to $35\frac{1}{2}$ lbs. per mile, varying of course with the size of the engine employed to do the work, the smallest engines invariably consuming the smallest quantity of fuel for the same work done. The average consumption of coke during the half year ending 4th July, 1849, was $31\frac{1}{2}$ lbs. per mile for passenger engines, and $47\frac{3}{4}$ lbs. per mile for goods engines.

These returns refer to a stock of about 200 engines, and a length of line of about 310 miles.

Thus the writer came to the conclusion that it would be possible to construct a carriage and engine combined, of sufficient capacity for branch traffic, and by his advice the directors of the Eastern Counties Railway gave orders to Mr. Adams to construct such a carriage, subject to the approval of Mr. Hunter, the locomotive superintendent.

The carriage was accordingly built, and called the "Enfield," from the branch which she was intended to work.

The diagram shows the "Enfield." The engine has 8 inch cylinders and 12 inch stroke; driving wheels 5 feet diameter; distance between centres 20 feet; width of framing 8 feet 6 inches. The boiler is of the ordinary locomotive construction, 5 feet long by 2 feet 6 inches diameter. The fire-box is 2 feet $10\frac{1}{2}$ inches by 2 feet 6 inches.

There are 115 tubes of $1\frac{1}{2}$ inch diameter and 5 feet 3 inches in length, giving a total of 230 feet heating surface in the tubes. The area of the fire-box is 25 feet, giving a total heating surface of 255 feet.

The weight of this steam carriage is 15 tons 7 cwt. in working trim. The engine and carriage being combined, it is evident that the weight on the driving wheels is increased by the load carried, and that this weight increases in the same ratio as the load required to be taken.

The extreme distance between the centres of the leading and trailing wheels being 20 feet, accounts for the steadiness of this machine; there is indeed no perceptible oscillation when travelling at the highest speed, and this verifies the observation "that the steadiness of an engine depends not on the position of the driving wheels, but upon the length of the rectangle covered by the wheels." This engine at the same time daily traverses curves of 5 or 6 chains radius.

The "Enfield" steam carriage was originally intended to convey 84 passengers, but as it was found that when she was put on as an express train the passengers increased in number, a "North Woolwich" carriage, was attached capable of conveying 116 passengers, and also a Guard's break van, making provision altogether for 150 passengers, which is now her regular train taken at a speed of 37 miles per hour.

This engine commenced her regular work about eight months since, and the following return shows the miles run and coke consumed by this engine during the $7\frac{1}{2}$ months regular working from January 29th to September 9th, 1849.

14,021 total miles run.

705 hours, running time.
1,457 ditto, standing time.

2,162 total hours, in steam.

743 cwt. coke consumed in running.
408 cwt. ditto standing.
286 cwt. ditto getting up steam.

1,437 cwt. total coke consumed.

11·48 lbs. per mile average consumption of coke.

The "Enfield" is in steam 15 hours per day, the fire being lighted about six in the morning and drawn at ten o'clock at night. But of these 15 hours it appears by the return that she is engaged running only 5 hours, the remaining 10 being employed standing in the siding. It was found by experiment that the quantity of coke consumed standing was 32 lbs. per hour, and after deducting this and the quantity consumed getting up steam, it will appear that the actual consumption of coke running is under 6 lbs. per mile.

It must also be particularly borne in mind that this consumption of coke includes the total goods and coal traffic on the branch, amounting to 1410 tons; viz., 169 tons of goods and 1241 tons of coal.

The "Enfield" steam carriage worked the 10 a.m. passenger train from London to Ely on 14th June, a distance of 72 miles, taking behind her three of the ordinary carriages and two horse-boxes; she arrived at Ely 8 minutes before time, and the total consumption of fuel, including the getting up steam, was found to be $8\frac{3}{4}$ lbs. per mile. The tubes of the boiler are only 5 feet 3 inches in length, and the economy of fuel is consequently scarcely at the maximum.

Another engine on a similar plan to couple with a 40-feet carriage is now nearly ready, the tubes being 6 feet 6 inches long, from which is expected even more economical results.

The result of the writer's experience is the conviction, that for express purposes, and for the larger portion of the branch traffic on railways, the light steam carriage is the best adapted and most economical machine, both as to first cost compared to the work done, and in working expenses.

The repairs of the permanent way are also very much reduced, as may be easily imagined.

The philosophical analysis of the question appears to be as follows: railways are constructed for the transit of passengers and goods; for the latter, which are capable of division into small parcels, some latitude of form and structure may be allowed; for the former, the stature and properties of man give a fixed standard. The carriage in which men are borne should be lofty enough to permit of standing upright when desired, for comfort to the rich and economy to the poor, as a larger number may be conveyed standing than sitting in a given space. The height being settled, the *width* must be so proportioned as to exceed the height by nearly one-third, in order to induce steadiness, bearing in mind that in a railway carriage there are two bases, the "spring base" of the frame on the axles, and the "wheel base" of the wheels on the rails. To secure a sufficiently wide "spring base" the axles should be projected beyond the wheels, and in practice a body 9 feet wide may be obtained, where the width of the railway in centre and side spaces will permit. But this width being obtained, it becomes essential to get a proportionate length to insure steadiness. Practice has verified this on the Eastern Counties Railway, where for two years past carriages 40 feet long and 9 feet wide, on 8 wheels (30 feet from centre to centre), have been traversing the most difficult curve and gradient in England, the radius at one part being 189 feet.

The largest floor area per wheel—the minimum of dead weight compared with the load and the carriage, with least resistance to traction is

thus attained. The result of this is, that the minimum of steam power is required to draw it.

No truth is more certain than that the number of travellers by railway is increased by the facilities given for travelling. If a large engine and train costs a given sum, and the departures are every two hours, supposing that engine and train could be divided into four, and a departure take place every half hour at no increase of expense, it might be assumed that the passengers would double their numbers; but it may easily be demonstrated that the expense would be lessened, because by improved arrangement the total dead weight is much reduced.

On the Eastern Counties Railway an engine and tender of, say 30 tons, a break van, a first class carriage, and three third class carriages, conveying, say 120 passengers, make a total weight of 59 tons, and the consumption of coke, as has already been shown, is on the average 34 lbs. per mile. A steam carriage weighing only 17 tons will transport the same number of passengers at from 7 to 8 lbs. of coke per mile when the best proportions are attained.

The first cost of a large engine, tender, and four carriages has been £4000. The steam carriage for the same number can be made for something less than one-half the cost.

The value of the railroad in lessening draught consists in its perfect horizontal level, and not merely its general level, but its close approximation to the character of a lathe-bed—a hard, inflexible, smooth, true, and equable surface.

With heavy engines having 5 tons weight or more on each driving wheel, it is impracticable to maintain any road that it is possible to construct in this condition; for supposing the timbering to be of sufficient surface, and the rails to be perfectly inflexible girders with their joints unyielding, the very iron itself will abrade beneath the tread of so heavily loaded a driving wheel, which whether of 8 feet or of 30 feet diameter, can only rest upon a mere point.

It is a matter of doubt whether more than 3 tons can be placed on a wheel at great speeds without destroying the metal.

But there is yet another question to consider. In order to start a train into motion a great amount of power is necessary, many times greater than that which is requisite to keep up motion.

This surplus power remains in the train under the name of momentum; and it must be obvious that the greater the total weight of the train the greater must be the momentum. If the road be in bad condition with loose joints, the momentum essential to the maintaining of motion is consequently absorbed by these concussions. In short, the joints are a series of holes, and many of our railways, relatively to the heavy engines traversing them, are practically worse roads than a well-made macadamised road is to a stage coach.

If thus the weights be reduced below the point which causes destruction, it is probable that the heavy item called "Maintenance of Way," and the still heavier item of replacement of rails, chairs, and sleepers, will nearly disappear.

Mr. Samuel further explained the diagrams illustrating his paper, and remarked that the "Fairfield" steam carriage on the Bristol and Exeter Railway had hitherto been worked with an upright tubular boiler, which had not proved satisfactory, and the regular working of the engine had been prevented by the difficulty in keeping the tubes tight; but a horizontal boiler had been substituted, and the engine was just starting to work with it.

The Chairman remarked, that the subject was one of great importance, and he hoped it would give rise to an interesting discussion, not leading into any unfriendly difference of opinion, but an exposition of a friendly difference.

Mr. McConnell said, the results given by Mr. Samuel in his paper afforded proof of great economy; but how far this description of miniature engine might be brought into use on railways in general, must be determined by actual experience to a greater extent than was yet afforded. He believed that the branch on which the "Enfield" engine had been running was as favourable for the trial of the engine as any that could be selected. He had himself had an opportunity of travelling on the engine from London to Enfield, when the performance was very satisfactory for the load conveyed; but any increase of load or additional amount of traffic would materially affect the performance of the engine, because with a just appreciation of economy it had been balanced as nearly as possible to the load expected.

If they could in the general management of railways ascertain the exact number of carriages required for the accommodation of the traffic, a great economy of locomotive power might be effected; but unfortunately, in practice, they were often required to provide something like a maximum of power for a minimum of traffic. He had no doubt that the circumstances of many railways, particularly in those districts where the traffic was nearly uniform, would oblige them to adopt a power more nearly corresponding to their wants and to the loads they had to take; for undoubtedly the power of many engines at present at work very far exceeded their real requirements. He agreed with Mr. Samuel that this extra weight on the rails must materially affect the question of maintaining the permanent way; and as the quantity of coke consumed while standing and getting up the steam are expenses constantly attending all engines, he thought Mr. Samuel was quite justified in taking credit for economy. He was not, however, prepared to say how far this description of engine might be made applicable; but should be very glad to see any effectual step towards economy in the expenditure of railways, and he thought Mr. Samuel deserved great credit for having made such an effort.

As applicable to the subject, he recollected that on the Birmingham and Gloucester Railway it was found desirable to employ an economical power for the purpose of traffic on the small branch line from the main line to Tewkesbury, and for this purpose he adapted one of the small American engines by combining the engine and tender on one frame, and by putting a tank on the top of the boiler. But the gradients were very abrupt coming out from Tewkesbury, and when they worked the goods and passenger traffic together they were frequently obliged to increase the number of carriages, and in some cases the power was insufficient. The engine had 10½ inch cylinders, with 4 feet driving wheels, and 20 inch stroke; the consumption of coke was from 15 to 17 lbs. per mile; and the gradients varied from 1 in 300 to 1 in 80. The pressure, however, on the American engines was very fallacious, for the spring balance only indicated about one-third of the actual pressure on the boiler, which was really about 100 lbs. per inch.

Mr. Adams, of Birmingham remarked, that the Enfield engine was all on one frame with the carriage; but a different arrangement was adopted in the Cork and Bandon engine, in which the engine and carriage were on separate frames; and he inquired the reason for adopting the former plan in the "Enfield."

Mr. Samuel explained, that as the length of coupling of the engine wheels in the "Enfield" was only 5 feet 4 inches, with an 8 inch cylinder, it was necessary to attach the carriage and engine on one frame, otherwise it would be too short to run steadily; the effect produced by the carriage was like the stick of a rocket in steadying the motion. But in the Cork and Bandon engine with a 9 inch cylinder, the length of coupling of the wheels was 10 feet, and no carriage was required to produce steadiness, as the rectangle on the rails was so much longer. In the case of large engines, where the distance between the axles had been increased to 16 feet a greater steadiness was observable.

There was accommodation in the carriage for 15 first class and 116 other passengers, giving a total accommodation for 131 passengers; and this he considered the most serviceable for working the express traffic. One of these steam-carriages was being prepared for working on a railway in Scotland, at a contemplated speed of 40 miles an hour. At the present time it was impossible to keep the road in good repair, especially on the old lines, in consequence of the enormous weight of the engines.

Mr. Slate asked whether it was anticipated that these small engines would prove as durable, and have as long a life-time as the present large locomotives.

Mr. Samuel replied, that he expected the small engine would be as durable for locomotive purposes, and even more so than an engine of larger dimensions; the bearings could be made larger in proportion to the strain, and the boiler being smaller in diameter the steam could be compressed with greater safety. The "Enfield" engine was worked at 120 lbs. pressure, while in ordinary engines it did not exceed 80, and hence an advantage of 40 lbs. was obtained. The heating surface of the fire-box was 25 feet.

Mr. McConnell said, they had a great number of small engines originally on the line, but they were not able to take the traffic. His experience was that in a long run the small engines exhausted themselves, and were not able to keep up their steam if they had anything like a load.

Mr. Samuel said he had, with the "Enfield" engine, made the quickest journey that had ever been performed between Norwich and London. With a train capable of containing 84 passengers they performed the distance of 126 miles in 3 hours 35 minutes, including stoppages. Another advantage in a large carriage of this description resulted from making use of the side space, for there were only eight wheels to do the work of 24, and at the same time they had no greater amount of weight on each wheel than under the ordinary arrangement. The whole weight was 9 tons without passengers, and 84 passengers might be taken at an average as weighing 6 tons.

Mr. McConnell said, that undoubtedly with the present carriages the proportion of the tare to the passengers carried was very great; and although a case which rarely happened, instances had occurred where the tare was 50 tons to 3 tons of passengers. But even taking the weight of passengers at 10 tons, 50 tons of carriages was unquestionably a large proportion of dead weight to carry; and he considered that the long carriage, if always likely to be well employed, would be an advantageous mode of saving the dead weight, more especially on branch lines, and at the junctions where such branches came in.

The Chairman said, they were much indebted to Mr. Samuel for bringing the subject before them; and he only wished that more of their railway friends had attended the meeting, for it was a paper which well merited their deep consideration in the present depressed state of railway interests. The question of economy in the heavy current expenses of railways had for some time occupied his attention; and although he did not go to the full extent with the proposer of this new system, he nevertheless went to a considerable extent with him, and admitted that there were cases of passenger traffic, and branch traffic, and sometimes even short local lines such as that from London to Greenwich, London to Blackwall, or London to Broxbourne, where the number of short passengers was great, and the number left in long trains was very small, thus causing the train after a certain portion of the journey to work very disadvantageously. He had no doubt that companies would have to classify these trains to a much greater extent than had hitherto been done, and in that case the present plan might be tried with advantage; but he could not go with Mr. Samuel in saying that an engine so light as he had described was applicable to express travelling.

Even the principle of attaching a carriage to the engine for the purpose of giving adhesion, appeared to him a very doubtful expedient, because small engines were much heavier in proportion to their power than large ones. He considered that Mr. Samuel's arrangement in the case of the Cork and Bandon engine was a good one, but attaching a carriage to an engine was very objectionable; it was like rivetting harness to a horse, and could not be desirable under any circumstances whatever. Mr. Samuel did so to increase the weight on his driving wheels, and consequently obtain more adhesion; but he forgot that he had already more weight on the driving wheels than was adequate to drag the carriage along. This was adding more than enough, because an engine that weighs only 5 tons is not so capable of slipping upon the rail as an engine that weighs 30 tons, and therefore attaching a carriage upon the frame of a small engine was superfluous, and the inconvenience arising from having them rivetted together would in some cases be exceedingly great, more especially in working a station.

Cases however might presently arise which would be favourable to the development of the proposed system; for instance, railways had been laid down where hardly any justification existed for their construction; these must be worked at the least possible cost, and Mr. Samuel's plan might be adopted advantageously; but let not his very useful system be overstrained because there was no great branch line, express or otherwise, to which it could by possibility be applicable. It would be largely applicable to minor branch lines, but he (the chairman) felt that if he were to allow this paper to be read without saying anything, considering the position which he occupied in the railway world, it would be taken as a tacit acquiescence on his part in the broad principle of applying small engines where in fact for a period of nearly 20 years (ever since 1831) they had been doing everything in an opposite direction to that which Mr. Samuel was now pursuing. Hitherto they had been contriving engines to develope railway traffic on the main trunk lines, where not only great dispatch, but great comfort is exacted; and he would ask whether the public would be satisfied to be packed up like fish, ninety in a carriage. That they would not be content with inferior accommodation was sufficiently evident from the eagerness with which on the arrival at a station, persons made their way to the four inside carriages, which he thought were much more conducive to comfort than the broad guage carriages with eight inside.

Mr. Samuel remarked, that in his carriages he thought there would be more and better accommodation than afforded by the present system, as not only were they 9 feet wide, but high enough for the tallest passengers to stand upright if they felt disposed.

The Chairman did not think that the loftiness of the carriage removed the objection, because it was quite possible for a crowd to be very closely packed.

Mr. Samuel replied, that he allowed the same floor area for each passenger as in the present system.

A vote of thanks was passed to Mr. Samuel for his paper.

INSTITUTION OF CIVIL ENGINEERS.

November 13, 1849.

JOSHUA FIELD, Esq., President, in the Chair.

IN accordance with the resolution of a Special Meeting of Members, the Sessions of the Institution commenced on Tuesday evening, instead of, as heretofore, in the middle of January. This is a great improvement, as it assimilates the routine of this useful Society to that of other scientific bodies. It will also prove very convenient to the country members, give a greater number of meetings, and enable the session to terminate brilliantly with the President's Conversazione.

The Annual General Meeting for the Election of the President, Council, and Officers, will take place on Tuesday, December the 18th.

The paper read was a "Description of the Coffer-dam at the Grimsby Docks," by Mr. Charles Neate, Assoc. Inst. C. E. It commenced by briefly noticing the importance of preliminary structures in all works of Hydraulic Engineering, and the difficulties generally attending their execution. The position of Grimsby, on the south shore of the Humber, was then described; its proximity to the sea; the natural shelter afforded by the opposite shore of Spurn Head; and the various advantages it presented for the construction of extensive docks.

A general description followed of the enclosure made for the purpose of the dock-works, which comprised an area of 138 acres, and projected five-eighths of a mile beyond the margin of the high-water line of the shore.

It was explained that the flatness of the coast necessitated this great projection, as it was requisite to found the new entrance locks in the low-water channel of the river, in order to secure, at all times, a sufficient depth of water for large vessels. These conditions regulated the position of the coffer-dam, which stood in a very exposed situation, and was entirely self-supported; its principal features were stated to be its extent, and the form of its construction. The length of the coffer-dam was 1500 feet, supporting at high water a head of water of 25 feet, whilst the excavation behind it was carried to 11 feet, below low-water. The form of the dam was that of a circular curve, with a versed sine of 200 feet, or nearly one-fifth of the span.

Several of the constructive arrangements were peculiar; the work consisted of a triple row of whole timber sheet piling, which derived interior support from counterforts or buttresses of solid sheet piling, driven at intervals of twenty-five feet throughout its length. The long or through-bolts were made to break joint and terminate at the middle row of piling, so that no water could pass along them through the dam. In the middle row of piling, wrought-iron plating was substituted for timber walings, which formed excellent longitudinal ties, and left an uninterrupted surface on the piling, against which the puddle would lie compactly.

It was stated that these arrangements had imparted an extraordinary degree of stability and tightness to the structure, which had resisted the effects of storms, and the pressure of the tides, in the most perfect manner, during a period of fourteen months.

A portion of the ground between the works and the shore was described as being of a soft, silty clay, probably the site of an old channel; and as it was found, after all precautions, impossible to raise any solid structure upon

it, the alternative was adopted of displacing it completely, by raising a bank of chalk-stone rubble, which sunk down to the hard bed of clay beneath.

This method was successful in forming a very fine embankment.

The abundant supply of water from Artesian wells in Grimsby was adverted to, and referred to the vicinity of the chalk hills.

The conclusion of the paper drew attention to the magnitude of the masonry works now advancing at Grimsby, and for the formation of which the coffer-dam was erected, and which, when completed, from the designs of Mr. Rendel, the chief engineer, and under the superintendence of Mr. Adam Smith, the resident engineer, will form perhaps one of the most useful, as well as the most important, maritime works of modern times.

November 20, 1849.

Joshua Field, Esq., President, in the Chair.

The discussion upon the Grimsby Docks being continued, the speakers, led by the Very Reverend the Dean of Westminster, in his usual able and energetic manner, were induced to diverge very widely from the original subject, to point out the acknowledged advantages that would result, from Engineers possessing a more accurate knowledge of Geology, and being able to discriminate between strata by an examination of the component parts, and to decide upon their origin, as a guide in judging of their capability of supporting the weights likely to be placed upon them in the construction of works.

The Rev. Dean gave many instances where, in his opinion, more accurate geological knowledge would have secured greater success, or have prevented casualties. He quoted particularly the borings and the report said to have been made previous to the commencement of the Thames Tunnel, and the recent statement, that the projected tunnel for receiving and conveying the sewage of London down to the Essex marshes, would, throughout its entire length, have been in the London clay. He showed, however, that no London clay was to be found eastward of St. Paul's, and that the plastic clay was constantly mistaken for it, in consequence of the observers not possessing a sufficiently accurate knowledge of the difference in the constituent features of the two clays.

On the other hand, although it was admitted, that an accurate knowledge of geology was most valuable to engineers, it was contended, that they were not so ill-informed on the subject, as had been assumed; they did appreciate the necessity of that knowledge, and although they might not be able to discourse upon it with the eloquence of a Buckland, a Lyell, or a Sedgwick, or to speculate so plausibly upon the events of past ages, no careful engineer ever decided upon the position, or mode of construction of his works, without a series of trial borings, a careful examination of the specimens and experiments on them, chiefly with the view of ascertaining their strength, or capability for sustaining weights. Instead therefore, of accusing engineers of knowing so little, it was rather a subject of surprise that they knew so much; for no profession demanded such varied acquirements, or the exercise of such general common sense and judgment.

It was shown, that the position of the Thames Tunnel was not determined by the report, or the results of the borings, but with a view to establishing a connection between particular localities. The borings were perhaps inefficiently made, as compared with those of the present day, with the improved apparatus now in use; but Mr. I. K. Brunel had made a very complete series of borings across the Thames, showing most accurately the strata of the bed, and no errors could have been induced by them.

The statement of the proposed sewer tunnel being in the London clay, never had been accepted by eminent men, who understood their profession, however it might have been argued upon, as an assumed fact, by Commissioners and Boards of Sewers.

The discussion was closed by the Dean of Westminster giving an example of the urgency for Engineers becoming Geologists; and on Mr. Rendel stating, that the clay at Leith was so hard as to require to be blasted, and yet that, when exposed to a small current of water, was completely dissolved within a fortnight, he at once explained it, as arising from the presence of a multitude of minute particles of mica, whose non-adhesive properties produced the speedy disintegration of the mass. This was admitted to be the fact, and had been observed and allowed for by the Engineer in the construction of the works.

NINETEENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Continued from p. 257.

Section A.—Mathematical and Physical Science.

"Further Contributions to Anemometry," by Prof. Phillips.—Referring to his former reports on this subject, the author said that his researches into the force and velocity of wind have been directed to the completion of a method of wind registration which should be independent of mechanical movements, momentum and friction. He wished to register the wind by one of the effects of the displacements of its molecules, not the movement of its mass. For this purpose only one method has occurred to him as a sufficiently applicable, viz., the evaporation of a liquid. He had experimented on water, saline solutions and alcoholic mixtures, and he found reason to think that with either of these liquids an instrument really indicating the movement of wind by the registration of the evaporation which the wind causes is producible. Such an instrument need occupy but a very small space, and will have the desirable quality of being most accurate in those very low velocities of wind which elude entirely Lind's Anemometer, and are scarcely sensible by any registering machinery. It will be remembered that for the interpretation of the register of evaporation with a register of wind velocity, it was necessary first to correct for the hygrometric state of the air. This being done, the cooling power of wind was found by experiment to be nearly as the square root of its velocity. In this experimental result Prof. Phillips was induced to place confidence, because it appeared to represent and flow naturally from what may be thought the true physical action of the moving air. Having lately occasion to examine extensively and carefully into the amount of air which passes (or is made to pass) through the rarefied passages of collieries, where the currents are sometimes so slow that machine anemometers even of a most delicate description are insensible to the movement of the air—where even the miner's candle affords but a rude guess, and where the situation is such that smoke or the powder-flask cannot be appealed to—he was happy to find that the problem was perfectly and easily solved by noting the cooling power of the current. For this purpose a registering or integrating anemometer is not required. The currents underground are steady, and required only an anemoscope or indicator of the momentary velocity. Evaporation from the wet bulb may therefore be abandoned; the common thermometer with its bulb clear of the frame will answer the purpose of experiment, in every conceivable instance.

"On an improved Integrating Anemometer, and Notices of Five Years' Observations at Edinburgh, Wrottesley, and Lloyd's," by Mr. F. Osler.—Mr. Osler first stated that from an aggregate of upwards of 50,000 additional hourly observations he had been enabled to test the accuracy of the report he brought forward in Glasgow respecting the hourly forces of the wind, and their coincidence with the curves of temperature; and that the result was highly satisfactory, being almost precisely similar to that recorded in the report just alluded to—the wind rising with the temperature with great regularity. The curve of temperature for each season corresponded with the curve of force; but from these observations it would appear that the period of mean force in the evening took place about half an hour before that of mean temperature—showing that the motion of the air declines more rapidly than the temperature. The whole of the stations comprise an aggregate of nearly 200,000 hourly observations—all of which were tabulated and reduced. The direction of the wind for each hour of the day, together with its force, was first tabulated; and from this an abstract was obtained, giving the total force and direction for every day. In reviewing the Wrottesley observations, which were carried out more fully than the rest, Mr. Osler called attention to the fact of disturbances in the currents of the atmosphere taking place at certain and apparently regular intervals. A comparative calm is followed by considerable disturbances;—these calms and movements appear to be periodical. It was possible that observations for a longer time might neutralize these periods, and by shifting their times only leave us with the knowledge that intermittent pulses do not occur; but the regularity of some led him to hope that such is not the case, and that a law of periodicity might be traced even in this variable

climate. From six years' records at Wrottesley, the average periods of greatest movements in the aërial currents took place towards the end of January, the middle and end of March, the end of April, the early part of June, a short time after the middle of October, about the 20th of November, and the first week in December—the periods of greatest calm occurred about the middle of January, about the 17th of June, and about the 14th of November. There were many other maxima and minima; but Mr. Osler thought it desirable to defer going more into detail respecting them until he had been able further to investigate the subject. On minutely examining the registers of the anemometers, two kinds of currents are observed—the one moving very regularly and with great steadiness, the other in large pulses or waves, causing the vane to oscillate over a considerable arc. One he regarded as the air moving to fill up a void or deficiency—the other flowing from an excess or from a portion of the atmosphere being put in motion and carried on by momentum previously acquired, causing great undulations in its motion, on which occasions the wind appears to have much more force than is really indicated by an instrument. The north winds generally showed less oscillation than those from the south points. While carrying on these observations, Mr. Osler's attention had occasionally been directed to particular storms; and he had applied to them the rotatory theory set forth by Col. Reid, in the main principles of which he fully agreed; but he considered that a rotating circle would not explain all the changes that occur. He was of opinion that the rotating portion is smaller than has usually been assumed, and that the air approaches this circle or vortex in spiral lines—that sometimes this rotating circle is not in contact with the earth, in which case the lower current will be more in the direction of radial lines—that the air in advance of a storm is not put into such rapid motion in consequence of the movement forward of the storm itself—while for the same reason the action in the rear of the storm is increased. Mr. Osler then exhibited and described his improved integrating anemometer.

"On a Specimen of Incombustible Cloth for the Dresses of Ladies and Children, manufactured in Dundee, by Mr. Latts," by Sir D. Brewster.—This cloth of printed calico, of which several specimens were exhibited, was prepared by immersion in phosphate of magnesia. When inflamed it soon went out without the flame spreading; and Sir David stated that a spark or red coal would not ignite it.

"On an Improved Photographic Camera," by Sir D. Brewster.—The improvement was, to find the place of the focus of the object-glass not by a piece of ground glass as in the common method, but by an eye-piece with a properly graduated adjusting power. By this contrivance the plate or paper on which the photographic drawing was to be formed could be placed in focus much more accurately; and besides, the instrument when reversed formed an excellent telescope.

Mr. Ronalds said he had for several years used this method of placing his paper in focus, at the Kew Observatory.—Sir D. Brewster said, he was not of course aware that any other person had used this method, but supposed it entirely his own invention. One of the advantages of the association was in this way to inform observers of what others had been doing.

"Report on recent Applications of the Wave Principle to the Practical Construction of Steam Vessels," by Mr. J. Scott Russell.—During the last year I have had more than one opportunity of applying the wave principle to the construction of steam vessels. There is one case, however, in which I have been able to apply it to practice under circumstances of greater complexity and difficulty than have ever occurred to me, and where it has been successful in overcoming difficulties to a greater extent and in a more decided manner than heretofore. During the last year a very difficult problem was proposed to me. It was this—to build a steam vessel that should be fast without great length, a good sea-boat without drawing much water, and to carry a great top weight and yet swim very light. Besides, this vessel was to be able to go backwards as well as forwards equally well; and, though a small boat, was to contain great accommodation. The problem is one to which the wave principle is far from seeming peculiarly applicable. In the first place, it is well known that the wave principle prescribes a different form of the bow from that of the stern, in order to obtain most speed with least cost of power. In the second place, it is known that a high speed requires on the wave system a very considerably greater length than was here allowed for the entrance of the vessel or the lines of the bow. It would therefore seem at first to be a case that would prove too difficult for the successful application of the wave system. There is one more feature in the case which gives it interest. At the same time the same problem was worked out by another party on another plan of construction, *not* on the wave principle. Another vessel was built under similar conditions, and furnished with engines of the best construction, made by one of the most eminent engineers in England. Both these vessels were built at the same time and tried under similar circumstances; therefore, here was a case in which the practical value of the wave principle has been brought to a test more direct and less questionable than any that was likely to have occurred—and, therefore, more important to be placed on the records of the British Association. The first question which will naturally occur to a member of this Association who recollects this principle will be this: How could you apply the wave principle in a vessel made to go equally well both ways? The first answer is ready—it is this, that the vessel cannot be made to go so fast as if designed with equal power to go only one way—seeing that in one case she would have a best possible bow and a best possible stern, and in the other case could have neither. The next point is this, that in both cases of bow and stern it was necessary to have a compromise. Each required to be in turn bow and stern—this was accomplished in the following manner:—If their be any point which has more forcibly struck me in the application of the wave principle than another, it is the flexibility of the wave principle—the extent to which it admits of deviations from its strict rules without losing the benefit of its asssistance. If it had unluckily been true of this system that it prescribed an exact mathematical solid in its three dimensions (like Newton's Solid of least Resistance), to which implicit adherence was imperative on pain of losing all the benefit proffered, then, indeed, the system would have been (like Newton's) of little use, from the fact that, from causes independent of resistance, ships cannot be solids of revolution, consistently with other qualities. The wave principle, on the contrary, possesses wonderful flexibility, first, from the circumstance of its prescribing lines *in one plane* only, and so leaving the other two dimensions in the hands of the practical constructor; so that the sections of the vessel in one plane being given by the system, the sections in two others are at the service of the constructor. I had in this case to lay down for both ends of the vessel, that which is best for a bow and that which is best for a stern, at the given velocity. I had next to place relative values on bow resistance and stern resistance. I had next to single out from between those two lines one which, taken either as bow or stern, would deviate least from either, and so have least resistance on a mean of both directions. This, therefore, the wave principle did—it gave the limits, and gave also the choice of a series of means all more or less suited to the purpose intended. I have now shortly to state the practical details by which this process was carried into effect, and the results arrived at in consequence. The engines of the vessel, as well as the vessel, had to be constructed by my partner, Mr. A. Robinson, and myself, and we were enabled to adapt the one to the other with greater ease and certainty than in all likelihood we could have done had the engineer been separate from the ship-builder. In our case the engine was considered and made an actual portion of the ship and the ship of the engine. It will be fair, therefore, to deduct from the good effects attributed to the wave form of the ship, such advantages as we possessed in building both engines and boilers and ship as one whole; still, it is fair to remember, on the other side, that the builders of the engines with which ours had to compete, have been celebrated for their efficiency and for the large actual power they have developed, when compared with their nominal power. It should also be remembered that the builders opposed to us had previously built the fastest boats of their district. The results obtained are as follows:—Both vessels were about 150-55 feet long; 22-22½ feet beam; 4 feet draft of water; 240 tons displacement; 150 horse-power, nominal; propelled by oscillating cylinders of 48 inches diameter, with the same proportion of stroke to paddle-wheel in both cases; and with only such differences as the engineers and ship-builders in each case considered likely to be most successful in carrying out the execution of their work to the best advantage. The terms prescribed to both builders by the engineer of

the proprietors being identical, and with only such latitude as should not form an obstacle to whatever might seem best suited for obtaining greatest efficiency.

RESULTS OF EXPERIMENTS ON VELOCITY WITH EQUAL POWER.

	Wave vessel.	Competing vessel.	
Speed	16·13	15·03	miles per hour.
Power	20·3	19·9	velocity of wheel.
Loss	4·17	4·87	slip of wheel.

These are the results of accurate trials, at the measured mile, made both with the tide and against it. It is important to observe the amount of slip, as it serves to show that it was no deficiency of the engine power which caused the difference, both engines having gone at, as nearly as possible, the same speed. In order that the statement just given may not lead to false conclusions, it is necessary to state what were those minor differences in vessel and engine which each constructor adopted as tending to greater efficiency. The wave vessel had a flatter floor, and was considerably squarer on the midship section, which was done for diminishing the depth of water as wanted for her use. In the other vessel, the consideration of draft of water was rejected or overlooked, and a finer midship section taken, although with a larger draft of water. In one case, also, the rudders were considered as part of the length of the vessel, and treated accordingly, and in the other case rejected from it. In the engines, also, although the diameters of the cylinders were identical, the stroke of the wave vessel was somewhat longer than the other, but the diminished effective diameter in the shorter stroke reduced them to nearly the same proportion. Thus far the experiments given only serve to prove that, practically, a considerably better result has been obtained by a steam vessel built on the wave principle than by a competitor built under conditions that are perfectly identical, in so far as the public and the owners are concerned. But as regards the purely scientific question, I shall add two other experiments with the wave vessel, which furnish data of a more permanent and precise nature—one at a higher, the other at a lower velocity.

EXPERIMENTS ON THE WAVE VESSEL.

I.	Velocity of vessel	15·14	miles an hour.
	„ of wheel	18·17	„
	Slip	3·03	„
II.	Velocity of vessel	16·50	„
	„ of wheel	21·20	„
	Slip	4·70	„

The area of midship section immersed was 89·4 feet.
The surface of vessel immersed was 3080·0 feet.
The area of paddle-floats was 26·8 feet.

The conclusion which I deduce from these last experiments is this, that by means of the wave form one may obtain a form of which the resistance shall be represented by $R = \frac{1}{20}$ A.H.S., instead of $R = \frac{1}{6}$ A.H.S., which is the lowest number given in any previous system of construction; A being the area of midship section, H the height due to the velocity of the vessel, and S the weight of a cubic foot of water.

"On Thunderstorms and the Formation of Hail," by Mr. E. Highton.—The author concluded from the flickering observed in a flash of lightning that concussions of the air, caused by the electric discharge, gave rise to the lightning and the rolling of the thunder. Hail he accounts for by the rapid descent of rain drops when first formed, causing a rapid superficial evaporation, which freezes the rest of the globule; this as it moves on grows larger by the cold condensing more vapour on its surface, of which a portion is also frozen by the continued evaporation, and this accretion goes on until it reaches the ground—its final rapidity being the result of the constantly diminishing resistance of the air in proportion to its weight as it grows larger.

"On an Approximate Mechanical Equivalent for the Auroral Action of the 17th and 18th of November, 1848," by Mr. E. Highton.—During this aurora the electric telegraph at the Watford tunnel was violently affected for many hours, the climax occurring at 3 o'clock A.M. on the 18th. The wires extend in the tunnel about one mile and seventy yards, and are exposed outside the tunnel at both ends for three-quarters of a mile. The indicators frequently flew from one side to the other during the display, and often remained permanently deflected for a considerable time at once. On several occasions the electric current passing was sufficiently powerful to attract the moveable armature of the stationary electro-magnet of a bell apparatus, so as to allow the alarum to be sounded. Mr. Highton found by direct experiment afterwards, that a pressure of one-third of an ounce was required to produce this effect. Then, by a simple calculation from the length and thickness of the wires, he calculates that 180 superficial feet of wire were exposed at the ends; and hence he comes to the conclusion that the auroral power, if similarly extended over a square mile of surface, would be equivalent to the lifting of seventy-five tons. But if it be contended that the entire wire in the tunnel was affected as well as that exposed outside, he then finds that the force over a square mile would be upwards of thirty-one tons.

The President exhibited a Universal Sun-dial, made by Mr. Sharp of Dublin.—It consists of a cylinder, set to the day of the month, and then elevated to the latitude. A thin plate of metal in the direction of its axis is then turned by a milled head below it till the shadow is a minimum, when a dial on the top shows the hours by one hand and the minutes by another. It appears that the time can be obtained by this to the precision of about three seconds.

SOCIETY OF ARTS.

President—H. R. H. Prince Albert, D. C. L., F. R. S. &c.

Session XCVI.

NOTES OF PROCEEDINGS.

November 7th.—The following address from the Council was read by the Secretary :—

The Council congratulate the members assembled upon the commencement of the 96th year of the Society's proceedings.

They congratulate the Society upon their increasing means of usefulness, and the cordiality with which their exertions for the public good are met on all sides. Their ordinary revenue has increased in seven years from 800*l.* to 1600*l.*; the whole of which is directly expended in the promotion of arts, manufactures, and commerce. It is a remarkable feature in the present state of the Society, that it now expends no more money upon its establishment of officers and servants than it did in 1841, when its condition was the reverse of prosperous. The present list of fifty-eight candidates for election as members may be appealed to as an event altogether without precedent in the history of this Society, and attests its growing power and usefulness.

The Council have during the sessions issued a prize-list for 1850, in its various departments of agriculture, arts, mechanics, and manufactures, in which it will be observed that upwards of 600*l.* worth of premiums and medals are offered for competition. They are happy to add, that at the head of the list stand the two gold medals of H.R.H. the President. The Society has to be congratulated on the admirable exhibition of paintings which clothed the walls of the great room during summer. It was visited by thousands of persons, who then saw for the first time these great historical paintings.

We believe that, until that exhibition, Mr. Etty's transcendent merits were only fully appreciated by the limited circle who had hitherto been fortunate enough to see his greatest works. The Council think it right to express once more their sense of the liberality and enlightened zeal for the promotion of art, with which Sir William Allen, the President of the Academy of Painters of Scotland, and the members of the Council, allowed their great works to be exhibited here for the first time: and to all the possessors of these paintings public thanks are due for their liberality and readiness in sending them for exhibition. It is a matter of pride to this Society that they have already been the means of making better known to the public the character and genius of two living painters so distinguished as Mr. Mulready and Mr. Etty.

The Council feel it their duty to allude, however briefly, to a great undertaking, which, originating with his Royal Highness Prince Albert, has long been an object of deep interest and gradual preparation, and to which allusion was made in this room at the last general meeting. The members recollect that it was stated on that occasion that the great object of a National Exhibition of Industry was more likely than it had ever before appeared to be carried out to a successful issue. This anticipation is now in a fair way to

be realised. But as the Council have the intention of summoning a special general meeting for the purpose of laying before the Society the past history and present position of that great undertaking, they will not further go into the subject, because it is one of too great importance to be treated in a cursory manner.

But as an appropriate preliminary to such a statement, the Council have thought it well to place before the members the Report of Mr. Digby Wyatt on the great French Exposition of last summer. The Council thought it wise that the Society, having entertained from time to time this national subject, should put itself in possession of what other countries had done towards such an undertaking, although nothing at all approaching to the grandeur of the design and the extent of the exhibition had hitherto been undertaken in any country.

In Mr. Digby Wyatt the Council found a gentleman possessing the requisite professional talent and the taste and judgment required to carry out this view with the greatest benefit to the public. You will find, when you hear the report, that he has done it also in a manner most creditable to himself.

Mr. Digby Wyatt's Report on the 11*th French Exposition of the Products of Industry.*

Extracts from this Document (which is about to be printed for public use) were read, and verbal explanations given by the author.

The Report, after alluding to the attention paid by the French Government to the development of the manufactures of that country by precept, example, premiums, public exhibitions, elementary schools, societies of encouragement, &c.; to the traditional excellence of early French productions, and to the modern restoration of that super-eminence, by the means before-mentioned, now persevered in, with few interruptions, for fifty years,—was divided into three parts.

The first embracing the details of construction, cost, and arrangement of the building, which may be thus briefly described.

It was situated on the Carré de Marigny, abutting on the Champs Elysées; thus, as a site, offering every possible advantage:—

The whole plot covers a vast parallelogram of 675 feet by 328, being about 5 acres, round the outline of which runs a gallery 90 feet wide, divided into two avenues by a double row of pilasters. In the centre of each avenue is a set of stalls for the exhibition of merchandise. And both between the pilasters and round upon the walls other objects are placed, so that, in traversing either of the four gangways, the public have on both hands objects for inspection. The parallelogram thus enclosed is divided by two transverse galleries similarly arranged to that already described, forming three court-yards; the central being 140 feet square, and the two lateral 80 feet by 140.

The central court-yard is open, and in the middle an elegant fountain. Around are sheds for the exhibition of flowers and horticultural ornaments and implements. One of the lateral courts (enclosed) contains the objects in metal, cast iron, &c.; and the other an immense reservoir, in which all the drainage from the roofs is collected, so as to form a supply of water immediately serviceable in case of fire. In addition is constructed a vast shed, of a length rather greater than the width of the great parallelogram, and about 100 feet wide, for the exhibition of agricultural produce. A long narrow gallery intervenes between it and the main building. The whole of the building is constructed of wood, the roofs being covered with zinc, of which nearly 4000 tons have been used, and nearly 45,000 pieces of timber. By the plans (suspended in the great room), to which the author specially referred, was fully explained the foregoing description, and that an unnecessary expenditure had been gone into. Carton pièrre trusses apparently support the timbers, and a painted bas-relief fills the tympanum of the pediment at the principal entrance. The architecture of the whole is *mesquin.*

Mr. Wyatt stated that the exposition

Of the years	Contained an area of square yards as under.	Cost of the building was:		The expenses of transporting the Goods to and from Paris.		The cost of rewards.		The Total Cost of the Exhibition.	
		£	s.	£	s.	£	s.	£	s.
1839	13,583	14,551	12	4847	0	2429	12	21,828	8
1844	23,310	14,056	14	5641	16	3238	0	23,937	4
1849	27,214	16,000	0	Not yet made up.		Not yet		made up.	

To this amount for the present year must be added £2,000, the cost of the agricultural shed, making the whole sum expended £18,000. It must be remembered that this money is paid only for the hire of the materials for about three months, the whole remaining the property of the contractor at the termination of the exhibition.

With regard to the classification of products of the last Exposition. After touching briefly on the classification of products in former years, Mr. Wyatt proceeded to give that adopted by the jury in 1844. They divided the manufacturing arts into—

1. Woven
2. Mineral
3. Mechanical
4. Mathematical
5. Chemical
6. Fine
7. Ceramic
8. Miscellaneous

} Arts on the accidental or natural system.

This arrangement led to confusion.

In 1849, no systematic classification appears to have been adopted, convenience of arrangement rather than the nature of the product being considered. The great uncertainty of the uniform supply of goods from year to year renders it extremely difficult to complete any preliminary arrangement. Thus machinery, which in 1839 was comparatively a minor item, is in 1849 a great and predominating attraction. The products of Mulhausen (cotton and mixed goods), which in 1839 required a large hall for themselves, sunk this year into the ordinary space required by other branches. It is in articles of taste, however, that French workmen exhibit their greatest strength. We scarcely ever see a bad piece of ornamental modelling. The human figure is rarely ill drawn, and we recognise everywhere a practised hand and a thoughtful head. With a few exceptions, the French are before us in every ornamental art; and in machinery also they have this year displayed their power in mechanical resources to an extent that would be alarming, if we were not ourselves in a state of continual progress. Mr. Wyatt also alludes to the excellent liberality of the French Government in the whole expenditure; to the perfect arrangement for free ingress and egress, and for unanimous movement. The catalogue contained a double series; and the exhibitors were allowed, with great advantage, to fit up their own stalls. The goods, however, on the whole, wanted arrangement, and the building had the defect of containing no one grand hall, where, as on the occasion of distributing prizes, a great assemblage might take place. Mr. Wyatt believes that a better building might be erected in England at a much less cost, probably by one-fourth.

The second contains a history of all the past expositions, from the original idea of the Marquis d'Avèze, in the year 1797, down to the present time; and a table is given showing the general conditions of many of them.

The third explains the official arrangements by which the Minister of Agriculture and Commerce is required to carry out each exposition. The institution of a central jury for awarding the prizes is said to have worked well; that jury consisting of retired merchants and manufactures, professors, engineers, and men of science, of a reputation and standing sufficiently high to place their verdict above all question.

The appendices consist of various papers, by means of which the formulæ of correspondence, &c., are conducted; and No. 4 contains the decree by which the last Exposition was announced to the public.

Third Ordinary Meeting of the Session, November, 21*st.*

T. Webster, Esq., F.R.S., Vice-President, in the Chair.

The proceedings commenced by the election by ballot of forty-six gentlemen as new members of the Society.

The Secretary having read the minutes of the last meeting, read a letter he had received from Mr. Wass relative to the death of Mr. Etty, to whose memory he paid a high eulogium.

The Assistant Secretary then read a paper on Flexible Breakwaters and Lighthouses, by Mr. W. H. Smith, C.E. The paper, after alluding to the losses and amount of property annually sacrificed on our coasts, referred to various efforts that have been made by means of floating breakwaters to effect an economical barrier to the sea.

The peculiar principle of Mr. Smith's proposed breakwater, is to give elasticity to the structure. The models exhibited were formed of a long wall of open piles divided into separate sections, each having an independent motion at the top, but secured and pivoted at the bottom on the screw pile. The braces (with counterbalance weights at the centre) extending seawards from each side, are also affixed by the screw-pile. The sections on being struck by the sea, yield to it, thereby eluding its violence, and the waves passing through the close grating are disseminated. The structure recoils when it becomes in equilibrium with the waves, and on its return still further cuts it up. Excepting in a storm, the breakwater is comparatively motionless. The author conceives it applicable in every situation to the formation of harbours. The material employed may be either wood or iron. The same principle of giving elasticity, is proposed to be applied to lighthouses whatever the variation of circumstance as regards depth of water, situation, &c. The object being to obtain the greatest possible strength, and least possible shock from the force of the sea, or wind-draft.

After a short conversation on the above subject, a vote of thanks was given to Mr. Smith for his communication.

Seventeen new members were proposed, amongst whom was the Marquis of Douro.

The meeting then adjourned.

INSTITUTE OF BRITISH ARCHITECTS.

An exceedingly full meeting took place at the institution on Monday evening, the 19th of November. Thomas Bellamy, Esq., Vice-President of the Institute, was in the chair.

Dr. Buckland commenced a paper on Artesian Wells by observing, that the architecture of the globe was a subject which he thought ought not to be foreign to the consideration of members of an architectural institute, for he must humbly submit that no architect could perfectly understand his profession unless he had acquired some knowledge of the materials with which he had to deal; and he believed no one would deny that, had their ancestors known as much as they did now touching the durability of various kinds of stone employed in the construction of ecclesiastical and castellated buildings, they would not have to deplore the ruin of so many of those edifices. It would be his duty to-night to direct their attention to the architecture of that particular portion of the earth which they themselves inhabited—a subject possessing an interest literally of vital importance. It was, as had been proved by the events of the last six months, a question of life or death to thousands and tens of thousands in this great metropolis, whether they should have the means of obtaining an abundant supply of fresh water. It was, unfortunately, too notorious that the supply of water was at the present time awfully defective, and the last month had been fertile in schemes of various kinds for supplying that defect. He would not enter into the relative merits of those schemes, but he would explain to them—so far as it was ascertained—the structure of that portion of the earth on which they dwelt in this great metropolis. He had affixed the term "Artesian Wells" to the subject on which he had to address them. In his "Bridgewater Treatise," which was published 13 years ago, he had written a chapter on this subject, and he might say that the result of his observations in England, had been entirely confirmed by the practical experience of some of the most eminent scientific men in Germany and France. Among the latter, were M. Hericart de Thury, and M. Arago. It had been asserted that sufficient quantity of water might be obtained in this metropolis, by artesian wells, to afford an ample supply to ten such cities as London; but he would venture to affirm, that though there were from 250 to 300 so-called artesian wells in the metropolis, there was not one real artesian well within three miles of St. Paul's. An artesian well was a well that was always overflowing, either from its natural source or from an artificial tube; and when the overflowing ceased it was no longer an artesian well. Twenty or 30 years ago there were many artesian wells in the neighbourhood of the metropolis, namely, in the gardens of the Horticultural Society, in the gardens of the Bishop of London at Fulham, and in Brentford and its vicinity; but the wells which were now made by boring through the London clay were merely common wells. He had heard it said that artesian wells might be made in any part of London, because there was a supply of water which would rise of its own accord; but he could state, with regard to the water obtained to supply the fountains in Trafalgar-square, that it did not rise within 40 feet of the surface (a voice—"80 feet"); it was pumped up by means of a steam-engine, and the requisite supply of water could be obtained at a much less cost from the Chelsea waterworks. Indeed, the same water was pumped up over and over again. (A laugh.) No less than £18,000 had been spent upon an artesian well which had been made on Southampton-common, but the water never had risen within 80 feet of the surface, and never would rise any higher. The supply of water formerly obtained from the so-called artesian wells in London, had been greatly diminished by the sinking of new wells. Many of the large brewers in the metropolis who obtained water from these wells had been greatly inconvenienced by the failure of the supply; and he had received a letter from a gentleman connected with a brewer's establishment, stating that the water in their well was now 188 feet below the surface, while a short time ago it used to rise to within 95 feet of the surface. Indeed, the large brewers were actually on the point of bankruptcy with regard to a supply of water. (A laugh.) There were, as he had said, more than 250 artesian wells, falsely so called, in London, one-half of which had broken down; and those from which water was obtained were only kept in action at an enormous expense. The average depth at which water could now be obtained from so-called artesian wells in London was 60 feet below the Trinity-house water-mark; and he believed that in 20 or 25 years more water would not be obtained at a less depth than 120 feet. This was, as he had said, a subject of vast importance to the inhabitants of the metropolis, who had not now a supply of water equal to one-fourth of what was required for their ordinary use. The Rev. Doctor, after going into a lengthy and elaborate geological description of the soil in the metropolis and the neighbouring districts, illustrating his observations with well-executed and interesting plans and sections, proceeded to inquire by what means a sufficient supply of water could be obtained for the inhabitants of the metropolis? He considered that an ample supply might be obtained from the Thames in the neighbourhood of Henley, after that river had been fed by the Lodden, the Kennett, and other tributary streams. The water might be conveyed to London by an open aqueduct of sufficient depth, parallel with the Great Western Railway; and, as it would have a fall of three feet, it would flow without the aid of any engineering works, and might be brought to a reservoir in a valley north of Paddington. It would there be at a level of 105 feet above high-water mark, and at that level two-thirds of the inhabitants of London might, by means of an engine, be supplied with water at high-pressure.

The Rev. Dean, in the course of his paper, referred to the derivation of the word "Artesian." An artesian well was a sort of well found in the time of the Romans, in arched walls. They were the Artesia of the Romans. When an artesian well ceased to overflow, it ceased to be an artesian well. The Rev. gentleman concluded by saying that upon careful consideration, the plan to which he alluded appeared to him the most feasible that had yet been suggested for affording to all the inhabitants of this metropolis an abundant supply of pure water; and he sat down amid loud and general applause.

After a few words from Mr. Clutterbuck, in explanation of some of the sections which had been prepared by him,

Mr. Tite said, that, as a member of the Institute, he felt bound to tender his thanks to the very Rev. Dean for the interesting paper with which he had favoured them to-night. (Hear, hear.) This was not a mere question with regard to the nature of artesian wells. He had not been aware before he heard it from the Rev. Dean that an artesian well was one that was constantly overflowing, but of this there could be no doubt, that what were called artesian wells required frequent deepening, and were a source of constant expense. He sincerely hoped that the Government would take up this question. (Cheers.) It ought to be looked upon as a national question; for a large city like this, containing so immense a population, ought not to be left dependent for the supply of so important and necessary an article as water upon private companies or individual speculators. (Hear, hear.)

Mr. R. Stephenson expressed his gratification at the paper which had been read, and observed, that though he did not wish to give any opinion as to the mode in which the rev. gentleman's views should be carried out, he must say that he had some doubts as to the practicability of the plan he had suggested. He thought that a measure which might tend to obstruct the navigation of so important a river as the Thames should not be decided

upon without most careful consideration; but the obstruction of the waters of the tributary streams would not be open to the same objection. He quite agreed with the rev. doctor that it could not be expected that anything like an adequate supply of water could be provided for the metropolis from artesian wells.

Mr. Homersham expressed his opinion, founded upon experience which he had had in Watford and the neighbourhood, that a sufficient quantity of water might be obtained by means of artesian wells to meet the wants of the inhabitants of the metropolis.

Mr. W. Horne said that, as the owner of an artesian well in Seward-street, Goswell-street, his experience tended to confirm the Dean's views as to the inadequacy of such wells as a source of supply to the people of London. It had been found necessary to deepen the well twice, and its working had been found very expensive, as the pipes and joints were constantly getting out of order.

Mr. Dickenson had had a good deal of experience with regard to artesian wells in the valley of the Colne. He had bored wells in four different places to a considerable depth, and in none of them did he find the water rise to the surface, although it rose somewhat above the level of adjacent springs.

A gentleman said he knew that an arrangement had been made by some of the brewers who obtain their supplies of water from what were called artesian wells, that they should not brew on the same days, in order that they might all have a sufficient quantity of water.

A vote of thanks was most cordially passed to Dr. Buckland for his admirable paper.

PATENT LAW REFORM.

(Continued from page 221.)

SELECTIONS FROM EVIDENCE.

WILLIAM CARPMAEL, ESQ., EXAMINED.

632. If a party attempted to obtain a patent for himself, probably the payment of successive fees would be troublesome, and the necessity for applying at the different stages would be a difficulty?—Clearly so. In going through the different offices, it is very readily done by persons acquainted with it; there is no trouble in it; they go from one office to the other and the officer at each office, if asked, will say, "You must take this to such and such an office." I think it is a question of revenue more than as to the means of collecting it.

633. Supposing the mode of obtaining a patent were simplified, would it not be necessary for parties to obtain professional assistance?—Just as much; but the professional assistance required in respect to taking a patent is very trifling as compared with the professional assistance required in a manufacturing point of view.

634. Are not the main points upon which a person requires professional assistance, the scientific part, the preparation of the specification, and the search as to other similar inventions?—Precisely so. The sum charged is not above eight per cent. upon the outlay. In passing a patent, the amount charged by the agent for obtaining a patent is but small upon the gross outlay.

683. Does it appear to you desirable that the grant of a monopoly of this sort should be accompanied with certain conditions which would deter the originators of trifling inventions from applying for such grants?—I cannot conceive any law that should interfere with that sort of thing. The amount I do not think ought to prevent the manufacturer of what may be called a trifle from having a patent for it, because a multiplicity of trifles makes a very important manufacture,—for instance a button, a needle, or a pin. Those are all trifles, but some of our richest patents have been taken out for such matters.

684. Is it not desirable to prevent the originators of unimportant improvements applying for patents upon slight grounds?—I think that it is very desirable not to grant patents for such a small sum that everybody would be running to the Patent Office.

685. Will you state the grounds of that opinion?—the point is this. Supposing a large number of patents, by reason of their cheapness, are taken out for, we will say, spinning, and then a very brilliant invention is made by any individual appertaining to spinning. In order that he should make that patent a good one, he ought to read either by himself, or those that assist him, every patent relating to spinning, and here he will find one piece that is similar to his, and in another patent he will find another piece that is similar to his, and in another he will find another piece that is similar to his, and so on, till at last the difficulties multiply in proportion to the number of patents granted upon this subject, and he would be a very clever man indeed who would make a substantive patent by reason of the immense number of rocks that he has to steer between. This would not be objectionable if each of the previous patents was for a valuable invention; but such would in practice never be the case, and in many instances, probably not one of them, standing alone, of any value to the public or patentee, but accumulated together by the new invention, a very brilliant result may be produced. In such cases great injury will be done to the real and useful inventor. By giving a man with little money a cheap patent, you are not doing for him a good thing. If you give it to a poor or a rich person, with only an imaginary invention, you ruin him by encouraging him to spend money upon a useless article. The cost of a patent, compared with the cost of bringing out a new invention, whether good or bad, is very small.

686. Do you think any advantage would arise from diminishing the fees upon the three patents to a less amount than about £100?—I think not; if a patentee could have an opportunity of either having it for England, for Ireland, or for Scotland alone, and he also had the power, if he chose, to take it for the three at once, it would be very desirable to reduce the total amount of the three, but not below £100. I do not think it would be desirato reduce the English patent much below £100.

T. WEBSTER, ESQ., EXAMINED.

723. I understand you to say, that you consider the principles of the law with respect to the rights created by the grant of a patent to be well established by recent decisions?—I think they are.

724. But that the mode of granting a patent, which has been derived from the general mode of making grants by the Crown, is inconvenient, and such as is not properly applicable to the peculiar right which is created by a patent for a new invention?—I think it is not. Patent property exists simply by virtue of a grant of the Crown; and the practice that has been followed in a grant of that kind of property was the practice followed in the grant of offices, and it is wholly inapplicable. The consequence of following that mode has been the introduction of many, I think very serious evils and grievances to patentees.

725. To follow a patent through its several stages, commencing with the first application to the Crown, which is sent to the Home Office, do you see any objection to that mode of originating the proceeding?—None whatever. I think the Secretary of State's Office is a very proper office for the commencement of it. But if in any general reform it were thought expedient to establish a Patent Office, or make it a branch of the Board of Trade, in reference to certain commercial restrictions that it has been thought advisable to insert in a patent (as the not allowing more than 12 partners), or of another office, it would be a different question. I think it is proper that the first step should begin at the Home Office, or some similar office. I see no objection to its beginning at the Secretary of State's Office. I am aware of no complaint, excepting as regards time and uncertainty, as to when the warrant has come back in its different stages.

854. Supposing the number of the fees was considerably diminished, and that they were payable only at two or three stages in the progress of the patent, according to your recommendation, do you think it desirable that there should be one gross sum, in the nature of a stamp duty, payable upon the patent when it is sealed, or that the payment should be annual, according to the French system?—I think I would combine the two; but I have not much considered that. Nothing can be worse than the present system; and I think if the price is to be kept up, that it would not do to require it to be paid in one gross sum, for this reason, that persons might like to have the advantage of going to a certain stage, and if so, they ought to pay for that. If an invention becomes abandoned before the Great Seal, he has that protection, and he ought to pay for it up to that stage. Therefore I should not

recommend one gross sum by way of stamp duty, though the cheapest to collect, especially as you must have some intermediate offices; but *I would press upon the attention of the Committee the policy of annual payments. I think it is a very good principle indeed.*

MR. WILLIAM SPENCE, EXAMINED.

1049. Do you think that it would be desirable to consolidate the fees into one or two payments? —No, I think that patentees, being very frequently poor men, require time for payment of the fees.

1050. Do you mean that the progress of a patent may be delayed, in order to spread the payment?—Yes, so long as you give the petitioner the benefit of the early date for a *bonâ fide* invention. I do not see any objection to such an arrangement.

1051. If a patent were allowed to date from the day of the application, would it not be necessary to require the applicant to prosecute the patent to completion within a definite time?—Yes; but you might spread that over some time.

1052. The only advantage that you see in a succession of fees is, that it enables a poor man to distribute the payment over a longer time?—Yes.

1053. Are you favorable to a plan for periodical or annual payments upon a patent? — It might, perhaps, be useful from the circumstance that the patentee would be induced either to prosecute his invention with vigour, or to abandon it according to its productive merits as they become developed by experience. But it might also be attended with difficulty by causing an uncertainty as to the number of patents actually in force at a given period.

1054. If a patent were worthless, would the person cease to make the periodical payment? —If he were convinced that it was worthless; but he would be slow in arriving at that conclusion.

1055. The periodical payment would enlighten his mind upon that?—Yes; but he would be slow to learn it for all that. I think that giving him time for making the payment is better than reducing the expense, the ultimate expense. I think it is a better principle, because in proportion as you diminish the expense of the patents, you diminish the productive value of the monopoly by letting in competition.

1056. You argue that it is desirable that, setting aside all questions of revenue, a certain tax should be levied upon patents to prevent their multiplication?—I do; but I nevertheless think that the question of revenue forms a necessary element in the whole question of patents, and ought never to be omitted in its consideration. I think each department of the State should be made to pay its own way, by the levying of a tax upon those most directly benefited.

1057. You think, on grounds of public policy, that it is desirable to prevent patents from being very cheap?—Yes, that is my opinion; because I think that for the patentee the two great points are security of property, and (so far as is consistent with public justice) freedom from competition during the term of the monopoly. And because for the public, I think that the important point is the real improvement of manufactures. I think also that payment in instalments in the way proposed would benefit the revenue by affording relief to patentees, and thus enabling many to take out patents who otherwise could not. At present many proceed as far as the Attorney-General's report, although they thereby get very little real protection for their invention, and none in a legal sense.

MR. WILLIAM NEWTON EXAMINED.

1072. Do you think it would be desirable to furnish the Attorney-General with any additional scientific advice besides that which he has now access to?—I think he rarely requires it.? The agents generally understand the subject thoroughly. He can, if he pleases, call in (which I believe he does sometimes, in matters of chemistry) professional advisers.

1073. For scientific matters, does the Attorney-General rely upon the information that he obtains from the patent agents?—I apprehend that he does in general. Sometimes he possesses a pretty good knowledge himself. But the committee will understand, that the discussions are only on matters of comparison between this thing and that thing; whether they are alike or not; not what are the powers of the machines. That he has nothing to do with.

1074. He has nothing to do with the merits of the thing?—Nothing whatever.

(To be continued).

REPORT OF THE COMMITTEE ON THE CONTRACT PACKET SERVICE.

The recent report of the Committee on the Contract Packet Service contains the details of the various contracts entered into by the Government, with the three leading ocean steam navigation companies, viz., the Peninsular and Oriental Company, the Royal West India Mail Steam Packet Company, and the Cunard Halifax and Boston Company. Regarding the first of these the particulars are as follow:—The duty originally performed by the company now known as the Peninsular and Oriental Company, was the conveyance of the mails to Vigo, Oporto, Lisbon, Cadiz, and Gibraltar, the contract for which was entered into on the 22nd of August, 1837. The company were to provide five steamers of not less than 140 horse-power, and were to run once a week. Before the contract was concluded it had been twice advertised by the Government for public competition. In the first instance the Peninsular Company sent in a tender for £32,860 per annum, and the Commercial Steam Packet Company also sent one in for £33,750, but neither were accepted. On the repetition of the advertisement the Peninsular Company offered for £29,600, and the Commercial for £29,560. In this case the Peninsular Company were successful, their offer being preferred on account of the better class of their vessels, the average horse-power of their five steamers being 233, while the average of those of the Commercial Company was only 154. The original contract was to take the mails on board at Falmouth, but it was subsequently altered to Southampton. The stipulated service is reported to have been admirably performed, "the only fault being that it had been done too well"—that is to say, the vessels arrived sooner than it was calculated, which was made matter of public complaint. In 1844, the company represented that departures three times a month, instead of once a week, would be sufficient for all commercial purposes, the unsettled state of the Peninsular interfering with the passenger traffic, while hostile tariffs limited the introduction of goods, and thus rendered the contract of the company increasingly unremunerative. The alteration was accordingly made, and £9,100 was deducted from the annual payment of £29,600.

The second branch of the service performed by this company is the monthly conveyance of mails between England, Gibraltar, Malta, and Alexandria. This contract was entered into in 1840, and the company then changed their name to the Peninsular and Oriental Company. The vessels employed were to be of not less than 400 horse-power, and capable of carrying four of the heaviest guns used in the navy. The terms were £37,000 for the first year, £35,000 for the second year, and a subsequent diminution of £1,000 a year down to £32,000. A further reduction of £3,500 a year was also made on the abandonment of a portion of the service, consisting of a fortnightly mail to Corfu. This contract was for five years, but it continued up to 1849. A new advertisement was then issued. In reply two tenders were received—one from the Peninsular and Oriental, and the other from the India and Australia Company. The Peninsular and Oriental tender was to perform the service for £27,500 a year, with reductions of £500 a year so long as the contract might continue, the vessels to be two of 450 and one of 250 horse-power. The India and Australia tender was for £25,650, with two vessels of 400 horse-power and one of 250. The Peninsular and Oriental Company pointed out that the contract should not lightly be removed from a company that had embarked so much capital, and had performed past services so satisfactorily, and at the same time they offered to concede to the Government all profits above 10 per cent. The Admiralty, however, found upon an examination of the books which they made with the concurrence of the directors, that no advantage to the Government was likely to arise from this, the shareholders having never received a dividend of 10 per cent., and there being no prospect of such a division. The Admiralty then made a offer to the Peninsular Company founded on the mileage rate paid to them for the Lisbon line. This was declined, but the company subsequently signified they would be willing to take £24,000 for the first year, with a diminution of £500 for each subsequent year. The India and Australia Company also made an amended offer, and the Government, finding the existence of competition, resolved to advertise again. In reply, the Peninsular Company sent in a tender higher than their offer by private contract. It was for £26,750, diminishing £500 for the first four

years. But the India and Australia Company's tender was for £18,450, and the Treasury directed it to be accepted. Although, however, they were allowed till the last moment for raising their capital, they were unable to do so, and the former private offer of the Peninsular Company was then agreed to. This contract will expire in 1853, upon 12 months' notice.

The third contract of the company is for the line commencing at Suez, and terminating at Hong Kong. This commenced in January, 1845, and is for seven years. The allowance is £160,000 per annum, £20,000 of which is paid by the Government, and £70,000 by the East India Company. The requisite vessels are three of 500-horse power, two of 400, and two of 250. The contract is stated to have been well performed, no avoidable breaches having taken place, and no serious complaints having reached the Admiralty except a memorial of the merchants of Hong Kong regarding late arrivals, which is still under investigation, the recurrence of the evil having, meanwhile, been in some degree provided against by the appointment of a special agent at Singapore.

The following table will show the total service now performed by the Peninsular and Oriental Company :—

Mail Service.	Number of Miles per annum.	Annual Payment.	Rate per mile.
		£.	s. d.
Peninsular	91,656	20,500	4 5½
Alexandria	70,944	24,000	6 9
India and China	219,360	160,000	14 7
Total number of miles	381,960		
Total payment per annum	... ...	204,500	
Average mileage rate	... ...	... ...	13 8¾

The Cunard Line.—The next important undertaking is the Boston and Halifax, or Cunard Company. The contract for this line was first advertised in Nov. 1838. Upon that occasion two tenders were received—one from the Great Western Company, who proposed to go once a month to Halifax only, and to provide three vessels of 350 horse-power, for £45,000 per annum; the other from the St. George's Steam Packet Company, who proposed to go once a month from Cork to Halifax for £45,000 (or for £65,000 if New York were included), with vessels of 240 horse-power, the engagement to be for seven years. Neither of these was accepted, and subsequently a proposition was made by Mr. Cunard. He submitted that by going once a week the whole of the letters would be carried by the steamers, and the American liners would cease to take them, and he offered to do this at less than half the sum per voyage required in either of the tenders. An agreement was made with him in the first instance to go twice a month to Halifax and Boston with vessels of 300 horse-power for £60,000. This contract was for seven years. It commenced July 4, 1840; and the terms were afterwards extended to £85,000, in consequence of additional vessels and larger size being required. Subsequently it was found that New York Companies were establishing lines, and Mr. Cunard then pressed the Government to fulfil the original plan of once a week. His existing contract contained a clause that, upon an extension of the service to four times a month, the same rate in proportion should be paid; but the Government considered £60,000 a sufficient sum in addition to the £85,000 already payable, and a ten years' contract was accordingly entered into in 1846 for a weekly mail for £145,000; not, however, until a delay had taken place, during which American lines had been formed, which will now increase and divide the traffic, both as regards passengers and letters. From the first organisation of this line, Government got back in postage as much as they paid, and the receipts have steadily incresed. The service is now performed every week from Liverpool to Halifax, and thence to New York and Boston alternatively, the average speed being 11 knots, and the vessels in use being 1,850 tons, and 700 horse-power, instead of 300, as in the original contract. Additional vessels are at present building, which will be 2,050 tons, and 800 horse-power. The company are at liberty to go to New York without going to Halifax, and, according to Mr. Cunard, they will probably do so as soon as the powerful opposition vessels now preparing at New York shall have commenced running.

The Bermuda contract, which is a branch of the Halifax line, had existed for 25 or 30 years by sailing vessels, the annual payment being £4,460, and for a year past it has been conducted by screw steamers on the same terms. Their average speed is about 8 knots, and they perform the passage between Halifax and Bermuda, which occupies from 3½ to 4 days, twice a month. The vessels are between 80 and 90 horse-power, the stipulation in the contract being that they shall not be less than 50 horse-power.

Pacific Steam Navigation Company.—In addition to these three great companies there is also the company by which the Pacific contract is carried on, and to which it is necessary to refer in order to complete our summaries. This company is in communication with the West India line, but it has no connection with it as regards capital or management. The Pacific Steam Navigation Company was projected by Mr. Wheelwright, after meetings had been held of the mercantile interest at Lima and Valparaiso and public competition had been invited, and it was established in 1840. For the first five or six years, however, no mail contract was granted, and the loss during that period was two-thirds of the paid-up capital. The contract ultimately obtained was entered into on the 29th of August, 1845, and it commenced July 1, 1846, to terminate upon 12 months' notice after five years. It was the result of private arrangement between the company and the Government (but not without competition, a Mr. Green, at Liverpool, having previously made an offer), and the terms were, to convey the mails between Panama and Callao and between Callao and Valparaiso monthly for £20,000 per annum, with four vessels of 150-horse power. Under this contract the annual mileage would have been 75,216 miles, but the company actually perform a mileage of 110,887, in order to satisfy the wants of the public, while at the same time, instead of employing vessels limited to 150-horse power, they have one of 150, two of 180, and one of 220, while a fifth is now building, being one additional to the contract, of 750 tons and 265-horse power. Last year the receipts of the Government for carriage of letters were nearly £17,000, and they are since supposed to have considerably increased, and to have reached very nearly the amount paid for the service. There has also been a great augmentation of the trade and general traffic of the company, and the directors have expressed an opinion to Government that semi-monthly communications should now be established, and that the change would prove profitable, it being feared that with vessels running only once a month foreign competition may come in from New York. In the two latter years of the existence of the company, dividends of 5 per cent. have been paid to the proprietors.

The Royal West India Mail Packet Company.—The West India Royal Mail Steam Packet Company remains to be noticed. Up to 1840 the cost of the West India mail service by sailing packets was 76,373*l.* per annum; but the contract for a steam route twice a month, signed on the 20th of March in that year, was to the amount of 240,000*l.* The service was a complicated one, and it was considered, that the advantages to be obtained by establishing it would be worth the additional outlay of 163,627*l.* The contract was for ten years, and as the company did not commence operations until the 1st of January, 1842, it will extend to the 31st of December, 1851. Meanwhile, however, it has undergone innumerable modifications. The difficulty of building, equipping and despatching the necessary fleet when such arrangements were almost in their infancy was found to be greater than the company anticipated. According to the contract, they were to maintain 14 steamers of 400 horse-power, but this was modified in 1846 to 10 steamers of 400-horse power, and four of 250, the latter for intercolonial service only. Altogether, five alterations of the routes have been authorized by the Admiralty. The cost of the first route was 745,146*l.* yielding 6s. 5¼d. per mile; while that of the present route is 421,104*l.*, yielding 11s. 4¾d. per mile. The average dividend paid by the company up to the present time has been less than 3¾ per cent. With regard to the yearly accumulation of a reserve fund 15 per cent. was considered by the Admiralty a fair amount for wear and tear and deterioration, but the company "have not been able to provide anything like it." The mileage now performed is 395,952 by steamers, and 25,152 by sailing

vessels, making 421,104 miles per annum, both ways included. The average speed does not exceed 8 knots, a rate which might be accelerated 2 to 3 knots an hour, but only by new ships, and a consequent outlay, "which," it is observed by one of the witnesses, "would be folly in the face of an expiring contract." From its commencement the service never appears to have been performed entirely to the satisfaction of the Government, but it has been gradually improved, and the plea is put forward that as the vessels have to call at 34 ports mostly without lighthouses or pilots, and the routes altogether are of the most intricate kind, it would be wholly unfair to expect results as exact as in the case of other lines. To these circumstances also are to be attributed the losses which have been incurred, and which have been as follows:—1. The *Solway*, lost on leaving Corunna at night. 2. The *Forth*, lost on the Alacranes rocks in the Gulf of Mexico, proceeding to Vera Cruz. 3. The *Tweed*, lost in the same manner as the *Forth*. 4. The *Acteon*, lost in rounding the point near Carthagena on a shoal extending much further than had been laid out upon the charts. 5. The *Isis*, which was damaged at Porto Rico, and repaired at Jamaica, and which foundered off Bermuda on her way to England in charge of another ship; and 6. The *Medina*, lost on a reef at Turk's Island in the night. Upon one occasion, in consequence of delay in the starting of one the packets, the company were required by the Government to pay a fine of 3,500*l*., which they consider to have been rather harshly imposed; and a further fine of 8,000*l*. for deficiency in the number of vessels employed, seems also at another period to have been resolved upon, although it was not enforced in consideration of the great disadvantages under which the company had laboured from the arduous nature of their contract.

ROYAL STEAM NAVY.

TRIALS OF STEAMERS, DOCKYARD INTELLIGENCE, &c.

Termagant, steam-frigate, 1,556 tons, twenty-four guns, 620 horse power, went out of harbour under Commander J. A. Stevens, of the *Blenheim*, on Tuesday the 13th, to make a trial of her speed and sea-worthiness under steam at the measured mile in Stoke's Bay, and to test the working of Mr. Grant's cooking and distilling apparatus. There was enough sea on to try the vessel well under every phase of tide, if not of wind, of which element there was a stiff breeze blowing all the time, but the vessel's speed was insignificant for her power compared with the performance of steamers of only auxiliary power by steam. Mr. Murray, C.E., superintending engineer of this dockyard; Captains Sulivan, Hayes, Mr. T. T. Grant, and other officers, were on board during her trial, which is considered a fair one. The exact performances of the *Termagant* were 6.501 knots as the mean speed of four runs along the measured mile in Stoke's Bay. The engines made twenty-four to twenty-seven and a half revolutions; barometer indicated twenty-five degrees; thermometer in engine room, ninety-five degrees; pressure of steam, thirteen pounds; she was deep, drawing seventeen feet two forward, sixteen feet nine abaft. Her cooking and distilling apparatus was set in operation the whole of the time, and prepared various condiments for the visitors on board, showing the excellencies of the invention and adaptation to the manifold necessities of a ship's officers and crew. It distilled one gallon of fresh water from that taken out of the sea, in one minute and ten seconds, and performed all its work in a most satisfactory manner. The *Termagant's* armament consists of eighteen long thirty-two-pounder guns on the main deck, of twenty-five cwt. each; six pivot-guns on her weather deck, viz., four broadside pivot-guns, ten inch (or eighty-four pounder), nine feet, eighty-five cwt. each; one pivot gun, sixty-eight pounder, ten feet, ninety-five cwt., forward; and another abaft; making in all twenty-four guns, exclusive of her two twenty-four pounder brass howitzers.

Minx, steam-vessel, fitted with a screw-propeller, has been fitted with a ten-horse power disc engine. The steam was got up on the 12th, to try the working of the engine in the basin, when it made 106 revolutions per minute. The diameter of the screw is four feet six inches, the ball of the engine ten inches, and the drum in which the ball works twenty-seven inches. The shaft of the screw descends to the stern of the vessel, at an apparent angle of thirty-five degrees from the engine. On the 14th, she went down the river under the charge of Master-Commander S. B. Cook, of the *Black Eagle*, with Mr. Taplin, second assistant to the chief engineer at the dockyard. The engine at starting made 130 revolutions per minute, but the average during the trial in Long Reach was 120 revolutions, the draught of water of the *Minx* being the same as on her last trial. The speed attained was 5.271 knots with the tide, and 2.0 knots against the tide, giving an average of 3.625 knots per hour. The engine worked during the the trial with a pressure of sixty pounds to the square inch. The speed was comparatively so little that she was towed back to Woolwich by the *Monkey* steam-vessel, Master Commander Bryant, at the rate of 8.45 knots per hour.

Opening of a New Dock at Portsmouth.—Another great addition to the facilities already possessed by this dockyard over all others was opened to general use on Nov. 3, a new and capacious repairing dock. This receptacle, now the seventh in the establishment, is an arm of the great new basin for steamers, and is especially constructed for the accommodation of that description of craft. Like the other great works before repeatedly alluded to, this new structure has been contracted for by Mr. Peter Rolt, whose name is associated with many great Government works—and completed under that gentleman's personal superintendence. Captain James, R.E., the Government officer in charge of works in this dockyard, has had the superintendence on behalf of the Crown. The dock was commenced in connection with the basin in 1844, and being now completed, exhibits one of the most symmetrical pieces of masonry in Europe. It length is 305 feet from the groove of the caisson, the breadth of the entrance is eighty feet, depth of dock thirty-two feet; depth of water twenty-one feet at the lowest spring tide. It would take in the longest and largest ship in the world at a dead neap tide, with every man and munition on board. Some idea of the magnitude of the work may be gleaned from the following items of the respective quantities of the material used in its construction:—52,800 cubic feet of beech timber; 20,800 cubic feet of Purbeck stone; 16,660 tons of shingle; 10,300 cubic feet of Portland stone; 2,954,300 bricks; 119,960 cubic feet of granite; 1,018 cwt. of iron, in pile shoes, &c. The actual cost of the dock is £67,000. It was opened on Saturday, in the presence of the Admiralty authorities, by the steam-frigate *Sidon*, which was hauled in for completion for service, after receiving new boilers, &c., in the adjoining basin. The infant son of Captain James, R.E., with a bottle of wine, performed the chief part in the ceremony of opening the dock, which, from the circumstance of the *Sidon* being the first vessel to occupy it, will be known henceforward by her name. The Inlet docks (other arms of the great basin, opposite the *Sidon* dock,) which are now in part built, also under Mr. Rolt's contract, and for which an immense amount of material is on the ground, will be proceeded with next year.

Portsmouth.—A Watt Institute has been established amongst the labourers of the great steam factory works of this dockyard, and on Tuesday evening 13th, a *soiree* was held at the Hall of the beneficial Society, to celebrate its foundation. Mr. Murray, the superintendent engineer of this dockyard, was called to the chair, and amongst the company (about 600 in number) were some of the leading scientific members of the Government establishments, the Naval College, the service, and the inhabitants generally, and a brilliant assemblage of ladies. Mr. Murray, in an eloquent address, exhibited the advantages of such institutions, and their influence on the members and public generally. A library, reading-room, and evening classes will be formed in this new institute, and lectures and public readings upon the most edifying and instructive subjects connected with scientific persuits periodically given. Captain James, R.E., of this dockyard, afterwards gave an able exposition respecting the origin of coal and iron, the geological position and extent of our iron and coal mines, and the mode of manufacturing iron from its ores, explaining the formation of coal from decayed trees, vegetable matter, &c. Mr. Spence, foreman of the steam-factory, delivered a most spirited address on the nature of mechanics' institutions, showing how much the working classes had the improvement of their condition in their own hands. The meeting was also addressed by Mr. Fincham, master shipwright of the dockyard; the Rev. T. Roe, chaplain to the contractor's men in the dockyard; the Rev. G. Barton, incumbent of St. George's, Portsea; Mr. Chigwell, Mr. Sheppard, &c. From the sentiments expressed and the good feeling that was manifested, this institution seems to promise to be of much future service to the artisans of the port.

STEAM NAVIGATION, SHIP BUILDING, ETC.

THE ORKNEY ENGINE.—His Royal Highness Prince Albert inspected the working models of the steam engine (described in our last No.) invented by Captain Fitzmaurice, on Tuesday the 6th; his Royal Highness afterwards proceeded to Datchet Bridge to witness the working of the engine in the boat fitted for the purpose.

INDIAN STEAM NAVIGATION. — A memorial to the India-house was last week agreed to by the Manchester Chamber of Commerce in favour of Mr. Bourne's plan for navigating the rivers of India by steamers with their burden so distributed as to draw only 12 inches of water. A similar memorial has also lately been transmitted by the leading merchants at Aberdeen.

STEAM YACHT FOR THE EMPEROR OF RUSSIA. — Messrs. Rennie have received orders to build a handsome steam yacht for his imperial highness the Emperor of Russia. She is to be 180 feet long, with a draught of water of only four feet, and calculated to run seventeen miles an hour.

LAUNCH OF THE "PROPONTIS."—A screw steam ship, built of iron, by Messrs. Mare and Co., Blackwall, from a design by Mr. T. Waterman, jun., was launched into Bow-creek, at 3h. 30m. p.m. on Monday, 19th ult. The *Propontis* is the third constructed for the General Screw Shipping Company, and of the same class as their two vessels, the *Bosphorus* and *Hellespont*. Her dimensions are—length 175 feet, breadth 25 feet 6 inches, depth 17 feet 6 inches, and tonnage 531 86 94, and she is to be fitted with auxiliary engines of 80 horse-power, by Messrs. Maudslay, Sons, and Field, and will be commanded by Captain Brenan. Mr. Thomas Jeffs named the vessel, and broke a bottle of wine on her bows, in the presence of E. Zorab, Esq., Ottoman Consul-General; James Laming, Esq., managing director; Captain Ford, of the Ottoman navy, superintendent; and a number of gentlemen who witnessed the ceremony.

THE GERMAN STATES' WAR STEAMER "INCA."—In our last No. we noticed the trial of the *Cora*, built by Mr. Patterson, of Bristol, for the German Confederation. We have now to report the trial of a sister vessel built and fitted by the same parties. The *Inca* is 166 feet in length, 27 feet beam, and 14 feet depth of hold. Builder's measurement 628 tons. She is schooner-rigged, and will have a crew of 65 men, exclusive of officers. She has oscillating engines with feathering paddle wheels, by Messrs. Miller and Ravenhill. The boilers are fore and aft, with two funnels. She was tried on the 13th inst., and make 6½ knots against a strong head wind and sea, the engines making 29 revolutions per minute, on her return she attained a speed of 11½ knots, in spite of the very rough weather, which made "playing at sailors," anything but a joke to the landsmen on board. We observe that the *Times*, in a very smart article, has drawn a comparison between the performance of this vessel and that of the *Termagant*, which though of much greater proportionate power, is of considerably less speed. This subject is so worn out that we can but allude to it.

DREADFUL STEAMBOAT EXPLOSION IN BELGIUM.—A deplorable and fatal accident took place last week at Bois-le-Duc, in Belgium, by which many lives were sacrificed. The boiler of the steamboat *Jan Van Arkel* blew up just as it was leaving the pier and with such force that a portion of it, weighing upwards of a ton, was thrown over the houses on the quay; another portion was thrown to a distance of 200 paces.

DEATH OF A FRENCH NAVAL ARCHITECT.—We regret to have to announce the death of M. Moissard Ingenieur de la Marine Française, which took place at Paris on the 1st inst., in the 49th year of his age, after a long and painful illness. M. Moissard was no less distinguished for his high scientific attainments as a constructor of ships than for his excellence as a man, and he is deservedly regretted by all who had the pleasure of his acquaintance. M. Moissard prepared the plans and superintended the building of many vessels both iron and wood, for the French Government, more especially for the Post Office Service, in the Mediterranean, and elsewhere. One of his last was the *Faon* packet, on the Calais and Dover station, whose speed and excellent performance have for some years attracted much attention. The French Goverment, we are assured, will experience a great loss in this valuable officer.

THE "NIAGARA" STEAM-SHIP.—The North British and North American mail steamer *Niagara* arrived at New York, from Liverpool, on the 19th ult. We have received particulars of the damage to her machinery, the fact of which was signalled to the *Canada*, when passing the *Niagara*, as reported in our last. On the 9th and 10th of October the *Niagara* experienced a severe gale from the north-west, during which she lost her cutwater and received other damage. On the 18th, when 24 hours out from Halifax, the side lever of the larboard engine broke directly in the centre, which rendered it useless. One of the engineers being at his post, stopped the starboard engine as soon as possible, but not in time to prevent the bending and breaking of the piston rod, and side rods of the air-pump, and the damage of the cylinder head. In fact, the larboard engine was nearly a wreck, and it was said a month would be occupied in repairing it. On examination, a flaw was discovered in the side lever, but whether it was caused by the shock when the figure-head was carried away or not, could not be ascertained. This is the first accident that has happened to the machinery of any of the vessels belonging to this splendid line of steam ships.

CHALLENGE FOR A RACE ACROSS THE ATLANTIC.—As the speed of the American and British steamers is often the subject of remark, we copy the following challenge, which appeared in the *New Orleans Picayune*, of Oct. 15. It is contained in a New York letter to the *Philadelphia Enquirer*:—"The extraordinary quick passage made by the screw steamship, *Ohio*, between this city and Charleston, occupying only about sixty hours, under the disadvantage of a new engine and foul bottom, has induced one of the proprietors of the line, Mr. George Law, to offer a challenge to any steamer in the world, to make a trip from this city to Liverpool, for a wager of 50,000 dollars a-side. I should not be surprised if the challenge be accepted; and if so, the excitement will be unprecedented, especially if accepted by one of the British steamers."

THE RUSSIAN STEAM-FRIGATE "ARCHIMEDES."

EXPERIMENTS MADE ON THE IMPERIAL RUSSIAN STEAM SCREW FRIGATE "ARCHIMEDES."

The following is an extract from the report of an officer of high rank in the Russian Navy on the performance of the above frigate:—

The experiments were made on the 19th, 20th, and 21st of September last, off the island of Hohland, in the Gulf of Finland, about 100 miles from St. Petersburg, in company with two other frigates, the *Smaly*, of 400 horse-power with paddle-wheels, and the *Cezarewna* sailing-frigate. These vessels were fully equipped, armed, and stored down to the load-water line. The experiments were carefully recorded by the officers and engineers belonging to the Baltic Steam Fleet, and corroborated by Mr. Rennie himself, who, representing his firm as makers of the engines of the *Archimedes* and *Smaly*, was also present.

The object of the experiments was to ascertain the power of the screw in propelling the *Archimedes* through the water under different circumstances of wind and weather, without and with sail and engines, separately or conjointly; the influence of the screw in steering, &c. The first trials were made on propelling the ship with and against the wind when all her masts, yards, and rigging were standing, the sails furled. Secondly, with sails and steam together before the wind, and abeam at different angles. Thirdly, with sails alone.

The following are the particulars of the *Archimedes*:—

	Ft.
Length between perpendiculars	179
Breadth	44
Depth	24
Burthen O.M.	1587
Displacement when the mean draft was 20ft. 8½in.	2141 Tons.
Area of midship section	601 sq. ft.

But the vessel being of wood left a square tuck behind, which tended to impede its velocity in consequence of the partial vacuum created behind; nevertheless, the steerage of the vessel was very easy. The engines consist of four cylinders placed horizontally, one pair of cylinders working opposite to the other pair, and connected to the screw shaft by cranks similar to the arrangements adopted in the *Vulcan* and *Megæra* iron steamers in the English navy. The action of the pistons is, therefore, direct upon the cranks and screw shaft, without the intervention of toothed wheels. The screw is 15 feet diameter and 18 feet pitch; it is of brass, and suspended in a brass frame by long upright screws, which, when the connecting clutch is withdrawn, serve to guide the frame and Archimedian screw when raised out of, or lowered into, the water.

The following tables show the results:—

RESULTS OF THE TRIALS OF THE RUSSIAN IMPERIAL FRIGATE "ARCHIMEDES," 330 H. P.,

In the Gulf of Finland, off the Isle of Hohland, Sep. 1849.

No.	(Wind light, top-gallant breeze) E.	Wind.	Duration of Trial.	No. of Knots.	Speed of Vessel.	Speed of Propeller.
			h. m.		Knots.	Knots.
1	With steam only...	Before the Wind.	2 0	43	6.5	7.65
2	Ditto	Against Wind.	1 26	39	3.5	6.92
3	Under steam, and all sails (except mainsail) set	Before the Wind.	20	43	6.75	7.63
4	Sails only	Ditto.	57	—	6.0	—
5	Under steam with shortened sails	Ditto.	33	40	7.5	7.1
6	All sails set (except mainsail)	By the Wind.	1 0	—	7.5	—
7	Ditto with steam	Ditto.	30	42⅓	6.75	7.5
8	Ditto ditto	Abeam.	30	47	7.75	8.34
9	Ditto (screw raised out of water)	By the Wind.	2 0	—	4.5	—
10	Under steam only...	Abeam.	55	44	6.5	7.81
11	Ditto	Wind a-head.	25	42	5.0	7.45
				(8) 340		
				42½		

Trial of Sailing between the *Archimedes* frigate, 300 h.p., with screw propeller, and 1587 tons, O.M., and the *Cezarewna*, 44 gun frigate, 1264 tons, 19th September, 1849, in the Gulf of Finland, off the Isle of Hohland.

Archimedes.	*Cezarewna.*
5 0 p.m. Light top-gallant sail breeze; both vessels close hauled and under the same sails, topsails, topgallant sails, jib, spanker, and foresail. Both frigates abreast of each other on port tack; speed 5 knots.	—
5 29. Propeller found to be right across the vessel, but which was afterwards set into a vertical position.	—
5 35. Started engine in addition to sails; steam rather low in boilers; numbers of revolutions 39; speed 6¾ knots. The *Archimedes* begins to gain on the *Cezarewna*.	Gaining a-head. About three-quarters of a mile a-head.
6 5. No. of revolutions 44; to windward of the *Archimedes*, and gaining fast; speed 7 knots. About 100 fathoms a-head; speed 5½ knots.	—
6 30. Both vessels right abreast of each other; *Archimedes* going a-head.	Sets mainsail.
6 37. To windward, and about 50 fathoms a-head; number of revolutions, 45.	Losing, with mainsail set; about 50 fathoms astern, and to leeward.

22nd Sept. 1849.—The *Archimedes* took the *Cezarewna* in tow, and went at the rate of 5 to 5½ knots per hour, for about 16 miles; light wind abeam; number of revolutions 45 to 46; pressure boilers 6lbs. per square inch; condenser 28 and 26¾ (no sail); barometer in the starboard engine 28⅜ inches, in larboard engine 27½ inches.

A last trial was made on the 1st of October last, with the *Archimedes*, in the presence of the Council of Admirals and Captains of the Fleet, with the same satisfactory results.

PROGRESS OF SANITARY REFORM.

Whilst the metropolis of the British Empire has been the scene of disgraceful squabbling between Boards of Health, Parish Guardians, Commissioners of Sewers, and all the various forms of jobbery which such corporate bodies are only too apt to assume, the provinces have bestirred themselves on the subject of sanitary improvement with an alacrity and unanimity which has been attended with the happiest resnlts, and which puts to shame the apathy and wrongheadedness of those who, from their superiority of position, might have been expected to have set a better example. Nottingham has honourably distinguished itself in sanitary improvement, and has reaped its reward in an almost perfect freedom from cholera, only eight cases having occurred in the last three months, and only six of those fatal ones. In 1832 there were 1,100 cases of cholera, 289 of which proved fatal. Such a disproportion between 1832 and 1849 indicates the amount of improvement that has been effected. From a report of the Sanitary Committee of Nottingham, we extract the following interesting details:—

"Since 1832, this town has emjoyed the blessing of an almost unlimited supply of wholesome filtered water, obtained from the River Trent, together with a supply obtained from copious springs in the neighbourhood. It is forced by day and night at high pressure along all our streets, and is capable of rising to the upper stories of almost all the houses in the place without cessation, throughout the year. The quantity taken by nearly nine-tenths of the dwelling-houses amounts to about 450,000,000 gallons per annum. This is equal, for the population supplied, to 18 or 20 gallons per head per day, or from 600 to 700 gallons per week for each family.

"The dwellings of the poor are supplied at a cost to the owner averaging about 5s. per annum for each house, or not quite $1\frac{1}{4}$d. per week. This is generally paid by the landlord, and, of course, received back again in the rent. There has been, usually, only one common tap in each court; often, however, two or more such taps are placed in larger courts and minor thoroughfares, to which all the inhabitants have, in fact, free access. The remaining small portion of the dwellings are supplied from other sources, at a somewhat higher rate of charge, and in almost equally liberal quantity. This admirable supply of water in Nottingham is of inestimable value, by promoting the cleanliness, health, and comfort of the people. Mr. Hawksley, civil engineer, has the great merit of laying down the principle of constant high pressure supply, and of its successful application in his native town.

"In the interval since 1832 the successive parochial highway boards have carried on operations in the lower districts of the town, which are those most closely inhabited, by paving or repairing the pavement of the streets in a substantial manner, sewering the undrained parts as they proceeded. This has had the effect of purifying the surface of the ground, and rendering the removal of noxious substances more practicable and easy.

"The use of an inexpensive asphalte, or mixture of gas-tar with solid materials, has been found an excellent substance for improving the macadamized approaches to the town, and still more for courts, inns, and stable-yards, and other confined spaces in the midst of dwellings, when applied to which it presents a perfectly even surface. It also dries as rapidly as stone slabs, and its use is highly to be commended for sanitary purposes. An extensive surface is covered with this material in various parts of Nottingham.

"The grave-yards of the town were inadequate to allow of the decent interment of the dead. A proprietary cemetery of twelve acres was laid out external to the town in 1836, in which 6,579 burials have taken place; added to which several acres outside the town were appropriated as a public burial ground at the time of the prevalence of the cholera in 1832, where many interments have since taken place. These have diminished intramural burials, and prevented the increased development and spread of pestilential vapours amongst the dwellings that surround the old grave-yards.

"Two public cemeteries, each of four acres, have been allotted outside the town, under the late Enclosure Act. The one is for the use of the members of the Church of England, the other for that of dissenters.

"But it was felt that all was not done which was needful to secure the health of such a densely crowded population. Therefore, nearly three years ago, the town council appointed a sanitary committee, which continues in operation at the present time. It has frequently reported the important facts which have formed the basis of its labours, and the council has strengthened its hands by its unanimous report, when needful. Thus it has obtained a moral influence amongst the greater part of the inhabitants as these facts and efforts to deal judiciously with them have become felt and well known.

"The authorities of the town not having delayed dealing with this subject, the intervention of the Central Board of Health was not needed, and the committee have acted under the authority and exercised the powers conferred by the Nuisances Removal Act. They deemed it, however, best to begin upon the principle of applying persuasive reasons rather than legal force, and have avoided direct collision with the prejudices of owners of property. Every complaint, signed by two resident house-holders, has been investigated, and the owners conferred with on the subject of improvements until it has been amicably arranged. Superficial as well as underground drainage has been attended to, and water has been laid on in the highest part of each court and yard, to afford the means of efficiently cleansing it. Privies erected without regard to decency or convenience, have been removed or improved, and the ends of closed courts have been opened to admit of free circulation of air."

Our readers may begin to imagine that the corporation is very rich and that its funds have been lavished in the praiseworthy endeavour to improve the social and physical condition of their poorer fellow townsmen. Yes; the expenses incurred by the sanitary committee in three years amounts to the enormous sum of 150*l.*! So much may be done with so few means when men are determined on acting instead of talking merely. Nottingham has set an example which we would fain see followed by every town in the kingdom. The Cholera has left us for a time. How long we may have given us to set our house in order, we know not, but this we do know, that every day the evil becomes greater with the increased density of population, and the task of cleansing the Augean stable becomes more difficult. There are two main points, which once obtained, all other needful reforms will flow from them. First, a large constant supply of water at high-pressure. Second, the total abolition of intramural interments. These are the points of the Sanitary Reformer's Charter.

NOVELTIES.

Power of Centrifugal Force.—A fatal accident occurred near Preston, on 22nd inst., from the disruption of the fly-wheel of an engine at the mill of Messrs. Levainson, Birley, and Co. An escape of gas having been perceived, a labourer was set to discover the leak, and it being early in the morning and dark, he took a light, and accidentally ignited the gas at the main, which had the effect of extinguishing all the lights in one portion of the mill, upon which the weavers threw all their looms out of gear. The engine, thus relieved of its load, acquired such a velocity that the fly-wheel was torn to pieces. The fragments demolished a partition wall in the engine-house two feet thick, and broke one of the columns of another engine near it. The engine driver was dreadfully injured in the attempt to stop the engine, as is supposed, and one of the foremen was struck dead. We are curious to know what description of governor and attachments, this engine was provided with.

Accident at the Britannia Bridge.—I have just noticed the report of the accident at the Britannia Bridge, which occurred during the lowering of the cylinder of the hydraulic press. The weight was 15 tons, and was hung by blocks on a large capstan, manned by 50 sailors, who were backing and lowering the weight, with 9 men to pay out the rope. The men stopped lowering, and left the turns of the rope at the bottom of the capstan just ready to surge. It did so, and the weight overpowering those holding on, the rope ran out, killing one poor fellow, and injuring several of the others. Now, I think, if they had had another capstan to take a few turns of the tail rope on, and had payed out with it, they might have lowered the weight with fewer men, and no risk from the surging.
W. D.

The Bristol Iron Works have been sold piece-meal by auction. The sale commenced on 22nd ult. The breaking up of these extensive works commenced with the sale of tools and materials, in which were many of the most improved machines by Nasmyth, Fairbairn, Hicks, Whitworth, Fox, Morgan, Haley, Sharp, Roberts, and other makers; then followed the machinery of the old erecting-shop, forge-shop fitted with steam-engines, lift-hammers, anvils, &c., smiths' shops, anchor-smiths' shops, brass foundry, &c. The sale throughout, according to the *Bristol Journal*, has been well attended by buyers from most of the engineering firms in Great Britain and the continent, and the lots have been well contested, and brought in most cases a fair value. The freehold and premises were sold for £11,470.

Smithfield Market.—A royal commission, to consist of the following members, has been appointed to enquire into the live and dead meat markets of London. Mr. G. Cornewall Lewis, M.P., (Chairman.) Hon. Frederick Byng, Sir Harry Verny, Bart., M.P., Sir James Duke, Bart., M.P., Mr. Wm. Miles, M.P., Prof. Richard Owen, Mr. John Wood, (Common Councilman of Aldersgate Without.)

The Singapore papers of the 7th October mention the arrival there of coal waggons, rails, and other stores for the coal-workings of the Eastern Archipelago Company at Labuan. The company have obtained Lord Grey's permission to name the shipping port for their coals on the north-east end of the Island of Labuan, "Port Raffles," in honour of the late Sir Stamford Raffles, the pioneer of civilization and freedom of commerce in the far East.

At a meeting of the Metropolitan Commission of Sewers, last week, Mr. F. Foster was appointed engineer to the commission, at a salary of 1500*l.* per annum, including expenses for travelling, within the limits of the jurisdiction of the court.

LIST OF ENGLISH PATENTS,

From October 18, 1849, to November 17, 1849, inclusive.

[*The first three names were omitted from the List of English Patents of last month*].

Ethan Campbell, of the city of New York, in the United States of America, philosophical, practical, and experimental engineer, and a citizen of the said United States, for certain new and useful improvements in the means of generating and applying motive power, and in propelling vessels. Patent dated October 18. Six months.

William Wyatt, of Waterloo Cottage, Oldswinford, in the county of Worcester, pump maker, for improvements in coating the surfaces of pumps, pipes, cisterns, and other articles of iron. Patent dated October 18. Six months.

Charles Felton Kirkman, of Argyle-street, in the county of Middlesex, gentleman, for certain improvements in machinery for spinning or twisting cotton wool, or other fibrous substances. Patent dated October 18. Six months.

John Cowley, of Walsall, in the county of Stafford, manufacturer, and John Hickman of Aston, in the county of Warwick, clerk, for improvements in the manufacture of bedsteads, chairs, tables, couches, and tubular and hollow articles. Patent dated November 2. Six months.

George Parke Macindoe, residing at Mountblow, in Scotland, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances. Patent dated November 2. Six months.

Adam Cottan, of the firm of John Elce and Company, of Manchester, machine makers, for improvements in machinery to be used in preparing and spinning cotton and other fibrous substances. Patent dated November 2. Six months.

John Jordan, of L[illegible], engineer, for certain improvements in the construction of ships and other vessels navigating on water. Patent dated November 2. Six months.

Frederick Octavius Palmer, of Great Sutton-street, Middlesex, gentleman, for certain improvements in the manufacture of candles, and also in the machinery for the manufacture of such matters. Patent dated November 2. Six months.

Lucien Vidie, of Paris, but now of South-street, Finsbury, French advocate, for certain improvements in conveyances on land and water. Patent dated November 2. Six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, in the distillation and treatment of tar and other products from coal, together with improvements in the machinery and apparatus employed for the said purposes. Patent dated November 2.—(Communication.)

Michael John Haines, of Lucas-street, Commercial-road East, leather-pipe maker, for improvements in the manufacture of bands for driving machinery, in hose or pipes, and buffers for railway purposes. Patent dated November 2. Six months.

William Buckwell, of the artificial granite works, Battersea, civil engineer; and Joseph Apsey, of Blackfriars, in the same county, engineer, for improvements in steam-engines and in propelling vessels. Patent dated November 2. Six months.

Hiram Tucker, of Roxbury, in the state of Massachusetts, of the United States of America, for a certain new or improved manufacture of mantel-pieces. Patent dated November 2. Six months.

William Morris, of Cold Bath-square, in the county of Middlesex, civil engineer, for improvements in the preparing of clay, and in the manufacture of bricks, tiles, and other articles made of clay or brick earth. Patent dated November 2. Six months.

James Combe, of Belfast, Ireland, engineer and machinist, for improvements in machinery for hackling flax and hemp, and in machinery for producing flax yarns. Patent dated November 2. Six months.

Alfred Barlow, of Friday-street, warehouseman, for certain improvements in weaving. Patent dated November 2. Six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for dressing, shaping, cutting, and drilling or boring rocks or stone, part of which improvements are with certain modifications applicable to machinery or apparatus for driving piles. Patent dated November 6.—(Communication.)

James Buck Wilson, of Saint Helen's, in the county of Lancaster, rope-maker, for certain improvements in wire ropes. Patent dated November 8. Six months.

Charles Edward Amos, of the Grove, Southwark, engineer; and Moses Clarke, of St. Mary Cray, in the county of Kent, engineer, for improvements in the manufacture of paper, and in the apparatus and machinery used therein; part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes. Patent dated November 10. Six months.

Charles Mathew Barker, of Lower Kennington-lane, Surrey, engineer, for improvements in sawing or cutting wood and metals. Patent dated November 10. Six months.

Robert Parnell, of the city of London, clothier, for a new instrument for facilitating the stitching and sewing of woven fabrics. Patent dated November 13. Six months.

James Chesterman, of the firm of Messrs. Cutts, Chesterman, and Co., of Sheffield, machinists, for improvements in carpenters' braces, and other tools and instruments used for drilling and boring purposes. Patent dated November 13. Six months.

Charles Cowper, of Southampton Buildings, Chancery-lane, for improvements in the manufacture of sugar. Patent dated November 14. Six months.

Louis Adolphe Duperrey, of 112, Faubourg du Temple, in Paris, engineer, for certain improvements in machinery for producing figures in relievo. Patent dated November 17. Six months.

Alfred Vincent Newton, of Chancery-lane, in the country of Middlesex, mechanical draughtsman, for improvements in manufacturing leather. Patent dated November 17. Six months.—(Communication.)

George Edmund Donisthorp, of Leeds, manufacturer, and James Milnes, of Bradford, in the county of York, for improvements in apparatus used for stopping steam-engines and other first movers. Patent dated November 17. Six months.

Charles James Pownell, Esq., of Kensington, for a certain mode or method, or certain modes or methods of ascertaining or registering the number of persons entering in or upon passenger conveyances and passage ways, and the instruments and apparatus for effecting the same. Patent dated November 17. Six months.

William Brindley, of Nelson-terrace, Twickenham, in the county of Middlesex, papier mache manufacturer, for improvements in producing ornamental designs on papier mache, and in preserving vegetable matters. Patent dated November 17. Six months.

William Buckwell, of the Artificial Granite Works, Battersea, engineer, for improvements in manufacturing pipes and other structures artificially in moulds, when using stone and other matters. Patent dated November 17. Six months.

Samuel Stocker, of High Holborn, hydraulic engineer, for improvements in beer engines, beer measures, and tobacco boxes, used by publicans. Patent dated November 17. Six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF SCOTLAND.

From the 22nd Day of August, 1849, to the 22nd Day of October, 1849, Inclusive.

James Nasmyth, of Patricroft, near Manchester, in the county of Lancaster, engineer, for certain improvements, and the method of, and apparatus for, communicating and regulating the power for driving or working machines employed in manufacturing, dyeing, printing, and finishing textile fabrics. Sealed August 24. Six months.

Job Cutler, of Birmingham, in the county of Warwick, gentleman, for improvements in the manufacture of metallic tubes or pipes. Sealed August 24. Four months.

Henry Gilbert, of Suffolk-place, Pall Mall, East, in the county of Middlesex, surgeon, for an improved mode, or improved modes, of operating in dental surgery, and improved apparatus or instruments to be used therein. Sealed August 28. Six months.

James Robinson, of Huddersfield, in the county of York, orchil and cudbear manufacturer, for improvements in preparing or manufacturing orchil and cudbear. Sealed August 29. Six months.

William Chambers Day, of Birmingham, in the county of Warwick, iron founder and weighing machine manufacturer, for improvements in machinery for weighing. Sealed August 29. Six months.

Robert William Thomson, of Leicester-square, esquire, in the county of Middlesex, civil engineer, for certain improvements in writing and drawing instruments. Sealed August 31. Six months.

John Holland, of Larkhall Rise, in the parish of Clapham, in the county of Surrey, gentleman, for a new mode of making steel. Sealed September 11. Four months.

Edwin Haywood, of Glusburn, in the county of York, designer to Mr. Thomas and Matthew Bairstow, of Sutton, in the county aforesaid, for improvements in plain and ornamental weaving. Sealed September 11. Six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments, and processes employed in the preparation and manufacture of flax and other fibrous materials. Sealed September 12. Six months.

William Boggett, of St. Martin's-lane, in the county of Middlesex, gentleman, for improvements in heating and evaporating fluids, and in obtaining and applying motive power. Sealed September 14. Six months.

William Edward Newton, of Chancery-lane, in the county of Middlesex, civil engineer for improvements in steam boilers. Sealed September 17. Six months.—(Communication.)

John Goodier, of Mode Wheel, Manchester, in the county of Lancaster, miller, for certain improvements in mills for grinding wheat and other grain. Sealed September 17 Six months.

Alexander Haig, of Smith-street, Stepney, in the county of Middlesex, engineer, for improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery. Sealed September 18. Six months.

William Henry Phillips, of York-terrace, Camberwell, in the county of Surrey, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property. Sealed September 19. Six months.

Sir John MacNeill, knight, of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways Sealed September 19. Four months.

John Mason, of Rochdale, in the county of Lancaster, machine maker, and George Collier, of Barnsley, in the county of York, manager, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous materials; and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same. Sealed September 24. Six months.

William Parkinson, of Cottage-lane, City-road, in the county of Middlesex, successor to the late Samuel Crossley, for improvements in gas and water meters, and in instruments for regulating the flow of liquids. Sealed September 24. Six months.

James Aitken, of Cook-street, in the city of Glasgow, North Britain, manufacturer, for certain improvements in the preparation of cotton and other yarns for weaving, and in the machinery employed therein. Sealed September 27. Six months.

John Robinson, of Patterson street, Stepney, in the county of Middlesex, engineer, for improvements in machinery for moving and raising weights. Sealed October 3. Six months.

Ernst Grapel, of Birmingham, in the county of Warwick, esquire, for improvements in marine vessels, in apparatus for the preservation of human life, and in moulding, forming, and finishing hollow and solid figures, composed wholly or in part of certain gum, or combination of certain gums; also improvements in dissolving the aforesaid gums, and in apparatus or machinery to be used for the purposes above mentioned. Sealed October 8. Four months.

Robert Clegg, Joseph Henderson, and James Calvert, of Blackburn, in the county of Lancaster, manufacturers, for improvements in looms for weaving. Sealed October 8. Four months.

Thomas Lightfoot, of Broad Oak, within Accrington, in the county of Lancaster, chemist, for an improvement in printing cotton fabrics. Sealed October 11. Four months.

William Gaspard Brandt, of 16, Compton-street, Brunswick-square, in the county of Middlesex, for improvements in the construction of the bearings of railway engines and railway and other carriages now in use. Sealed October 11. Four months.

George Henry Dodge, citizen of the United States of America but now residing at Manchester, in the county of Lancaster, for certain improvements in machinery for spinning and doubling cotton, yarns, and other fibrous materials, and machinery or apparatus for winding, reeling, balling, and spooling such substances when spun. Sealed October 15. Six months.

Charles Shepherd, and Charles Shepherd, Junior, both of Leadenhall-street, in the city of London, chronometer makers, for certain improvements in working clocks, and other time keepers, telegraphs, and machinery, by electricity. Sealed October 15. Four months.

Thomas Beale Browne, of Hampden, in the country of Gloucester gentleman, for certain improvement in looms, and in the manufacture of woven and twisted fabrics. Sealed October 15. Six months.

David Christie, of St John's place Broughton-lane, in the Borough of Salford, in the country of Lancaster, merchant, for welding and uniting cast iron with steel and malleable iron. Sealed October 19.—(Communicated.)

George Park Macindoe, residing at Mountblow, in the parish of Old Kilpatrick, and county of Dumbarton, for certain improvements in machinery or apparatus applicable to the preparation, spinning, and doubling or twisting of cotton, wool, silk, flax, and other fibrous substances. Sealed October 19. Six months.

Joseph Stovel, of Suffolk place, Pall Mall, East, in the country of Middlesex, tailor, for improvements in coats; parts of which improvements are applicable to sleeves of other garments. Sealed October 19. Six months.

Frederick William Norton, Lascelles Hall, Lepton, in the parish of Kirkeaton, in the county of York, fancy cloth manufacturer, for improvements in manufacturing plain and figured fabrics. Sealed October 19. Six months.

John Combe, of Leeds, in the county of York, civil engineer, for improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances. Sealed October. 22. Six months.

LIST OF PATENTS THAT HAVE PASSED THE GREAT SEAL OF IRELAND,

From the 21st day of August, 1849, to the 10th of November, 1849, inclusive.

Hugh Lee Pattinson, of Scot's House, near Gateshead, in the county of Durham, chemical manufacturer, for improvements in manufacturing a certain compound, or certain compounds of lead, and the application of a certain compound, or certain compounds of lead to various useful purposes. Sealed August 22. Six months.

Rees Reece, of London, chemist, for improvements in treating peat, and obtaining products therefrom. Sealed August 29. Six months

Thomas John Knowlys, of Heysham Tower, near Lancaster, esquire, for improvements in the application, removal, and compression of atmospheric air. Sealed September 10. Six months.

Charles Vignoles, of Trafalgar-square, in the county of Middlesex, civil engineer, for an improved method of preparing or manufacturing peat or turf for fuel. Sealed Sept. 10. Six months.—(Communication.)

George Fergusson Wilson, of Belmont, Vauxhall, for improvements in separating the more liquid parts from the more solid parts of fatty and oily matters, and in separating fatty and oily matters; and in the manufacture of candles and night lights. Sealed September 12. Six months.

George Nasymth, of Great George-street, Westminster, civil engineer, for certain improvements in the construction of fire-proof flooring and roofing, which improvements are applicable to the construction of viaducts, aqueducts, and culverts. Sealed September 18. Six months.

James Warren, of Montague-place, Mile End-road, in the county of Middlesex, gentleman, and Willoughby Theobald Monzani, of St. James's-terrace, Bermondsey, in the county of Surrey, gentleman, for improvements in the construction of bridges, viaducts, and aqueducts; and in anchors, and in drilling and boring braces. Sealed September 27. Six months.

Robert Plummer, of the town and county of Newcastle-on-Tyne, manufacturer, for certain improvements in machinery, instruments and processes employed in the preparation and manufacture of flax and other fibrous materials. Sealed October 1. Six months.

John Holland, of Larkhall-rise, in the parish of Clapham, in the country of Surrey gentleman, for a new mode of making steel. Sealed October 6. Six months.—(Communication.)